THE REUTERDAHL ATTACK ON OUR NAVY ANSWERED

SCIENTIFIC AMERICAN

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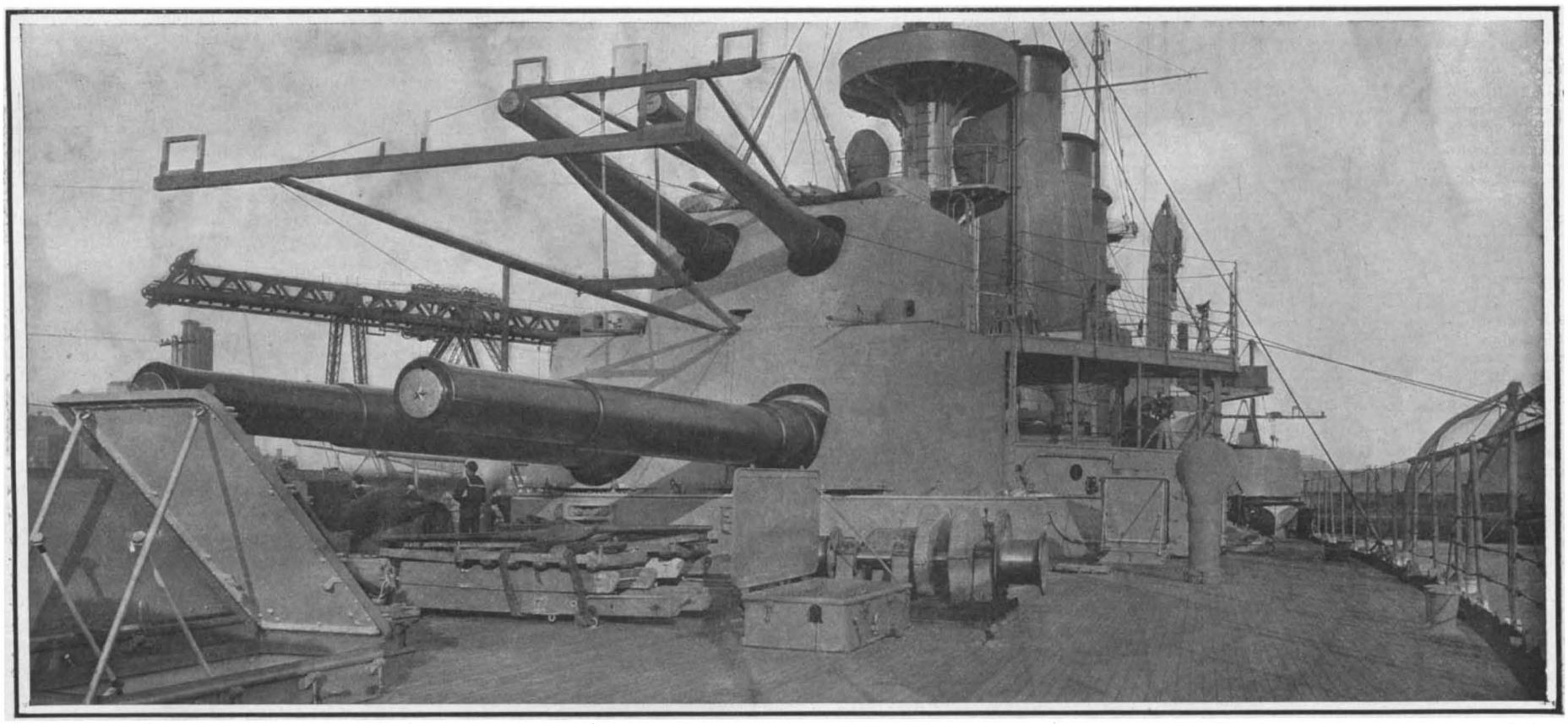
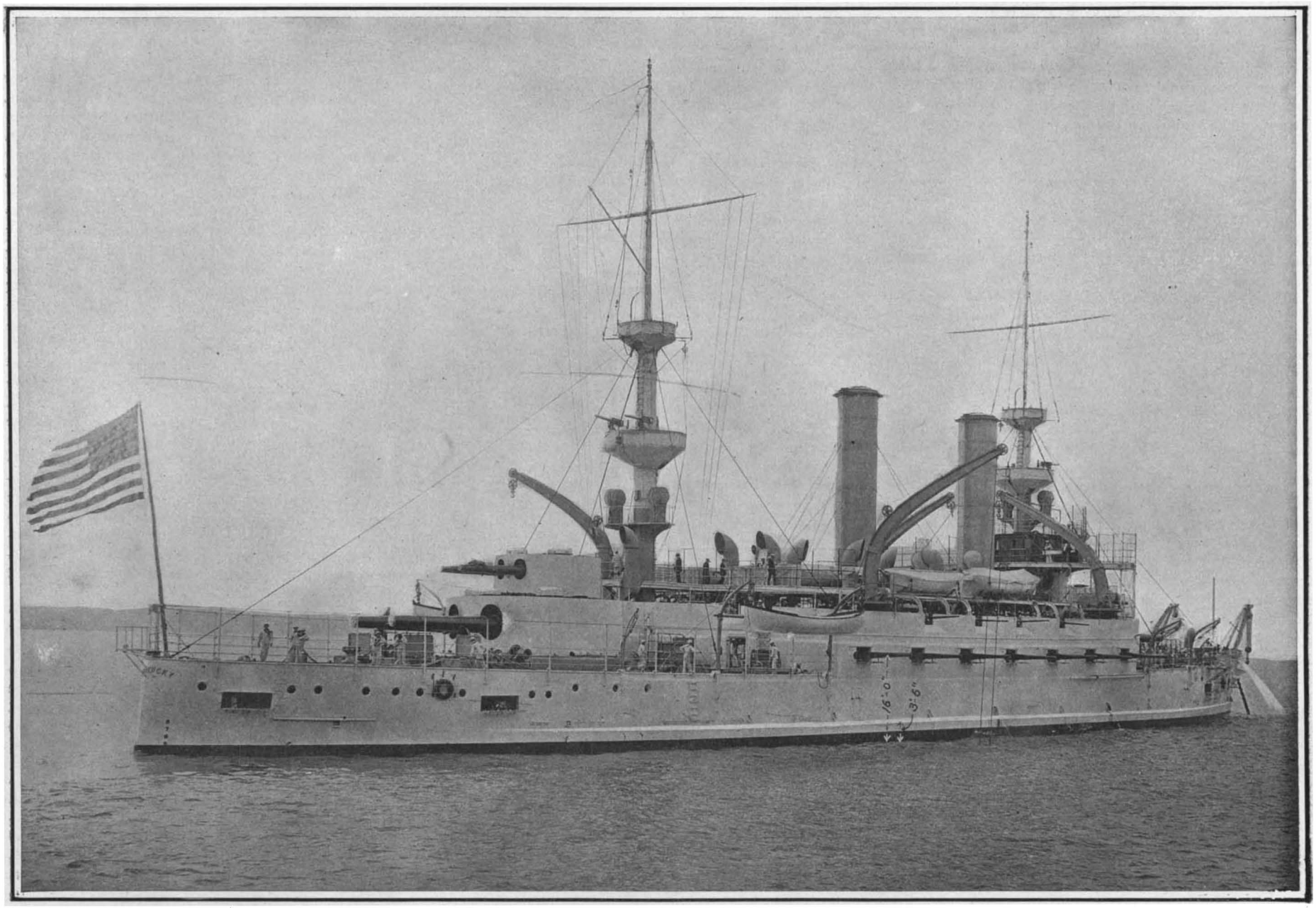


Photograph by Hall.

The inclined front wall brings the turret armor near the gun and enables the area of ports to be reduced. The large ports in the "Kentucky" were necessitated by the vertical front walls of her turrets.

The After Turrets of Battleship "Virginia," Showing the Inclined Front of Turret and Small Gun Ports.



Mr. Reuterdahl says: "The Russian battleships, when they went into that fight" (Tsushima), "were overloaded until the shell-proof armor was underneath the water. . . . . The ships of the battle fleet of the United States are in exactly the same condition as the Russian ships at Tsushima—not temporarily but permanently."

The above picture shows the "Kentucky" at normal draft of 23 feet 6 inches, weighing anchor to go to sea. Her "shell-proof armor" belt is not "underneath the water," but 3 feet 6 inches above it. Our other battleships show from 3 feet to 4 feet 3 inches of belt above the water at normal draft. At full load draft the "Kentucky" still shows 19 inches of her belt.

Battleship "Kentucky," Showing the Vertical Front of the Turret and the Large Ports.

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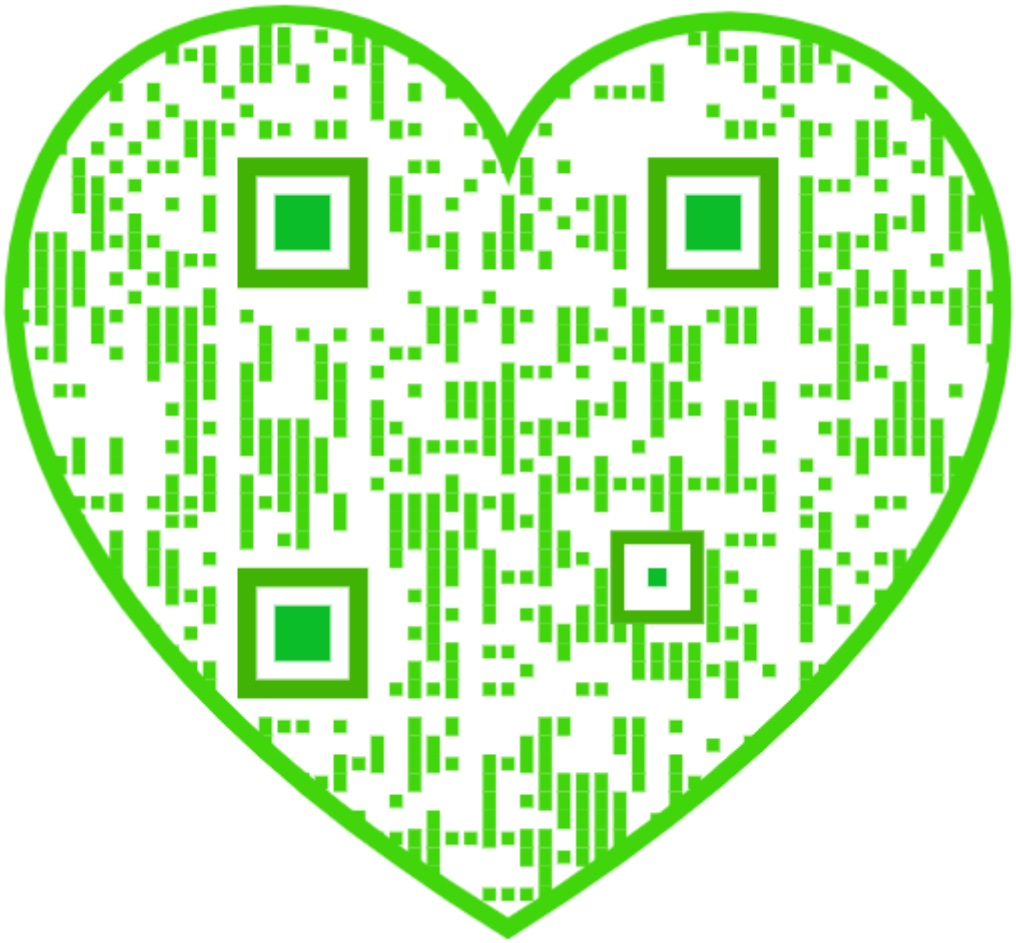

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

PANAMA CANAL TO COST $300,000,000?

The Chairman of the Canal Commission, Colonel Goethals, and ex-Senator Blackburn, the present Governor of the Canal Zone, recently appeared before the Interstate and Commerce Commission of the House to give information regarding the present state of affairs at the Isthmus. Colonel Goethals stated that, in spite of the great difficulties due to the wet season in the tropics, which he had expected to be the cause of much delay, the work was making more rapid progress than he had looked for. Nevertheless, he gave it as his opinion that the final cost of the canal would reach $300,000,000, this including, of course, the $10,000,000 paid to the Republic of Panama in purchase of the strip of land from ocean to ocean known as the Canal Zone, and the $40,000,000 paid to the French company as the price of the canal. This increase in cost is due largely, of course, to the greatly increased dimension of the canal and to the proposed increase of the locks from the original width of 90 feet up to 110 feet or more. Colonel Goethals stated that, at the present time, the number of laborers on the payrolls of the canal and the Panama Railroad fluctuates between 30,000 and 40,000, and that it consists mainly of Spaniards, Italians, and West Indian negroes. There is no scarcity of labor and, in fact, during the last two months there have been more men available than could be employed. Outside of a few machinists' helpers there are no Americans on the labor rolls.

THE PENNSYLVANIA TUNNEL EXCAVATION BENEATH MANHATTAN COMPLETED.

After three years' continuous work, the task of excavating the two tunnels of the Pennsylvania Railroad from the North River to the East River below Manhattan Island has been completed. They form the continuation of the two tube tunnels which have been built below the North River, and extend entirely across the island, one below Thirty-second Street, and the other below Thirty-third Street. The latter tunnel was completed several weeks ago, and the final blast which marked the completion of the tunnel under Thirty-second Street was fired on Saturday, January 11. At the present time the tunnels under both streets are practically in condition for the running of trains from the East River as far as Fifth Avenue. The concrete lining has been completed, and on some stretches the track is already in place. The work remaining to be done lies entirely in the section from Broadway to the North River. It is distinctly to the credit of the contracting company that, throughout the whole three years of construction, and in spite of the difficult nature of the work, the street traffic has not been delayed for a single hour.

GREAT INCREASE IN TRANSATLANTIC TRAVEL.

The statistics of transatlantic travel for the year 1907 are very startling; for the combined east and west traffic reached the portentous total of 2,957,328. As compared with 1906 there was an increase of 972,640 passengers, and of 1,451,151 over the total for 1904. There came from Europe to the United States 1,699,340 people, or 200,000 more than the combined east and west-bound travel in 1904. The east-bound travel during the past year was over one and a quarter million. The westward travel is divided as follows: First cabin, 107,965; second cabin, 226,687; and the west-bound steerage showed a total of 1,364,688. There is great significance in the figures for east-bound steerage travel, as showing the effect of the recent depression upon the labor market. This amounted to 550,045, or over a quarter of a million more than in 1906. This movement took place immediately after the October crisis and during the last two months of the year.

THE FARMAN AEROPLANE WINS THE DEUTSCH-ARCHDEACON PRIZE.

After several successful flights of a kilometer in a closed circle, made during the last few days of 1907, in which he managed to cover this distance, though not without the wheels of his machine lightly touching the ground at one or two places, M. Henri Farman finally, on January 11, at last made two unofficial flights without coming to earth except at the end of each. Two days later (on Monday, January 13) before the officials of the Aero Club of France, he repeated this performance for a third time, and won the Deutsch-Archdeacon prize of 50,000 francs ($10,000) for the first flight by a heavier-than-air machine of one kilometer in a closed circuit. The weather was perfect, there being practically no wind and the air being clear and mild. The flight was made above the parade ground at Issy-les-Moulineaux, some five miles out from Paris, at 10:12 A. M. At this time the aeroplane was started and run along the ground for 300 or 400 feet, in traversing which distance it attained its usual speed of about 30 miles an hour, and quickly ascended into the air to a height of 12 or 15 feet. It passed between the two posts which formed the goal for the start and finish, and flew in a straight line toward the 500-meter post. When about half way to this post, M. Farman operated his horizontal rudder, and caused the machine to rise to a height of about 25 feet. The areoplane swept around the half-way post almost on an even keel, and then took a straight course back to the goal, which it passed through at about the same height as before, descending 100 feet or so beyond in practically the same place from which it started. The time of this flight was 1 minute and 28 seconds, which corresponds with an average speed of about 25½ miles an hour.

Not content with winning the $10,000 prize, Farman once more flew his machine on January 15, for the purpose of ascertaining how much it would lift. He at first loaded it with 66 pounds dead weight, but he found that only a slight lift could be obtained with this weight. With 44 pounds dead weight the machine rose and flew for a few hundred yards, but it was unable to make a sustained flight. With but 33 pounds weight added, the machine flew from one end of the field to the other, and made a sharp turn when struck by a sudden strong gust of wind, which caused it to wheel around almost at right angles, and also to incline inward very sharply. After making the turn, however, it finished its flight on an even keel and at a height of 4 or 5 feet above the ground. In a final test Farman flew from one end of the field to the other, and skirted along the fortifications at this point in a large circle, covering in all more than 2 kilometers (1¼ miles) in a flight which lasted for nearly three minutes. This final flight was the longest which had thus far been made. M. Farman expressed himself as quite satisfied that his machine was being pushed to the limit as far as its lifting power is concerned. In all probability his next step will be to equip it with a more powerful and lighter motor.

By Farman's recent successful flights in a circle, the record of the Wright brothers made in this country over two years ago has in this respect been duplicated; but there are many other points to be considered when one reviews the practicability of aeroplane flight. In the first place, Farman has found that his machine in its present condition is incapable of long-distance flight, because of its inability to lift any perceptible quantity of fuel; while in the second place, he has not demonstrated its capability of flying with safety against a wind having a velocity of 20 miles an hour—a feat which the Wright brothers accomplished with their first motor-driven machine in 1903. While Farman's aeroplane has approximately the same weight as that of the Wright brothers, it is fitted with a motor of three times the horse-power, and of about one-quarter the weight per horse-power developed. In spite of their handicap in the shape of less horse-power and a much weightier motor, the Wright brothers' aeroplane made a speed of 40 miles an hour, as against 32½ miles shown by Farman's. Therefore the American inventors, by constructing a slightly larger machine and fitting it with an up-to-date, light-weight, aeronautical motor, should readily be able to carry two men and sufficient fuel for a flight of 125 miles, which are among the requirements specified by the War Department for a heavier-than-air flying machine.

In constructing his machine Farman has adopted the same double-surface type of machine as that used by the Wright brothers, to which he has added another pair of double surfaces at some distance back of the front planes (in conjunction with a horizontal rudder in front) for the purpose of steadying the latter in a fore-and-aft direction. In order to obtain the steadying effect desired, it is essential that the rear planes should remain practically horizontal, while the forward planes must be set at a considerable angle (about 15 to 20 degrees) in order that the machine shall lift at the speed at which the motor and propeller are capable of driving it. On account of the sharpness of the angle of advance presented by the forward planes (which angle cannot be decreased without giving to the rear planes a negative angle) it is impossible to obtain any higher speed when the machine is in the air, as the great air resistance encountered by the aeroplane when flying at so sharp an angle consumes the entire horse-power. Thus it will be seen that by the addition of the steadying pair of planes used by Farman to accomplish what the Wright brothers maintain by skill or by some secret method, viz., the longitudinal stability, he has decreased the efficiency of his machine by three at the least.

In view of the above-mentioned facts, while giving to M. Farman the credit for first publicly demonstrating that it is possible to fly in all directions, both with, against, and across a light wind, we nevertheless wish to recall to the aeronautical world the fact that to America belongs the credit of producing the first successful motor-driven aeroplane, and that to such men as the Wright brothers, A. M. Herring, and Gustave Whitehead—men who under the tutelage of Lilienthal and Chanute, have begun with gliding flight and gradually worked their way forward to the production of a self-propelled aeroplane in all its details, including the gasoline motor—belongs the real credit of having produced the first successful heavier-than-air flying machines.

PURE HYDROGEN FROM CARBIDES.

The manufacture of pure hydrogen in bulk has become a problem of the highest importance, owing to the recent advances in aeronautics as well as to its increased use in metallurgical processes.

Up to the present, the methods for producing hydrogen have been based either on the chemical action of acids or alkalis on metals, or on the electrolytic decomposition of water. Both of these methods are extremely expensive, yielding a very impure product, and do not lend themselves to operation on a large scale.

A novel method developed by Prof. Frank and his collaborators is based on the use of a gas mixture, known by the name of "water gas," which is produced by decomposing water vapor with the aid of incandescent coal. While this gas mixture, according to theory, should consist exclusively of hydrogen and carbon monoxide, it practically always contains considerable amounts of carbonic acid gas, oxygen, and nitrogen. Endeavors made about twenty years ago by Fritschi and Beaufils to obtain pure hydrogen from these gases by washing with a solution of copper chloride in order to remove the carbon monoxide, failed to give the result desired, the solution in question absorbing carbon monoxide but imperfectly and the other foreign gases not at all.

Prof. Frank insures the purity of the hydrogen produced, which is so indispensable to aeronautics, by conveying the water-gas over calcium carbide, submitted to a moderate heating in retorts. This substance readily absorbs carbon monoxide and carbonic acid gas, at the same time forming graphite and perfectly taking up all oxygen and nitrogen (the latter by the formation of cyanamide).

The technical water-gas, which contains on the average 50 per cent of hydrogen, 40 per cent of carbon monoxide, 5 per cent of carbonic acid, 4½ per cent of nitrogen, and ½ per cent of oxygen, thus yields in one operation a gas containing in addition to 99 per cent hydrogen very slight amounts of nitrogen and methane, while, according to Frank's previous investigations, the carbon separated in the shape of graphite can be utilized in some other connection. The apparatus required for this process is very simple, consisting merely of an ordinary coke-charged water-gas generator and slightly heated retorts filled with powdered calcium carbide.

Supposing the normal consumption of a large aeronautical station, e. g., a besieged fortress, to be 2,000 cubic meters per day, one apparatus would be quite sufficient. In order further to reduce the consumption of the somewhat expensive calcium carbide, an apparatus constructed with the assistance of Prof. Linde is resorted to, which by compression and cooling converts the carbon monoxide to the liquid condition. After removing any carbonic acid that may be present by the aid of a lime filter, the separated carbon monoxide yields in a gas engine the power required for the compression work, thus constituting a very economical cycle.

The experimental apparatus is designed for a supply of 10 cubic meters of water-gas per hour. An even more extensive use of pure hydrogen is to be looked for in the autogenous welding of metals, especially in soldering iron to iron, the more so as the recent cheap manufacture of oxygen will greatly assist in this connection.

THE PATENT OFFICE IN 1907.

The Report of the Commissioner of Patents for the fiscal year ending June 30, 1907, has been issued, and shows a considerable increase in the amount of business transacted.

During the year there was filed a total of 66,795 applications, including 56,514 for mechanical patents; 816 for designs; 192 for reissues; 7,869 for registration of trade marks; 982 for registration of labels, and 422 for registration of prints. In addition to these applications, there were filed 1,900 caveats. There were issued 33,644 mechanical patents; 529 design patents; 165 reissues; and there were registered 8,798 trade marks; 660 labels, and 325 prints. The number of patents which expired was 25,322, while 4,707 letters patent were withheld for non-payment of the final fees. 14,565 applications were allowed, and awaiting the payment of the final fees.

A decrease in the number of trade marks, prints, and labels registered and designs issued is noticed, but there is a slight increase in reissues, and a marked increase in the number of mechanical patents, the increase for the calendar year 1907 over the calendar year 1906 being 4,655, the largest increase for any one year in the history of the Patent Office.

The total receipts of the office from all sources amounted to $1,859,592.89 for the fiscal year, of which there were expended $1,584,489.70, including $932,665.59 for salaries, leaving a surplus of $275,103.19, which surplus was turned into the United States Treasury. The total net surplus of receipts over expenditures in the Treasury to the credit of the Patent Office on January 1, 1908, was $6,706,181.64, an amount derived entirely from the fees paid since 1837 by the inventors of the country directly or indirectly, and adequately sufficient for the construction of a much-needed new building for the Patent Office.

The present Commissioner, Mr. Edward B. Moore, in marked contrast to his predecessors, is a man who entered the Patent Office, not at its head, but at its foot. He was first appointed through civil service at the bottom of the ladder as a Fourth Assistant Examiner, and through twenty-four years of hard work has risen to his present position. Having served apprenticeship in all the grades, he is in possession of a most thorough and complete knowledge of the present condition of the office in all its detail, as well as being familiar with its development in recent years, when the work has been increasing at such a remarkable rate. He is a keen observer, and is wide awake to the needs and defects of his office. In his report he frankly acknowledges that a certain amount of poor work has been done in the past; that the office is far behind in its work, and that there have been many complaints; but, at the same time, he accurately places the responsibility and prescribes the remedies. At the end of the fiscal year, there were 13,634 applications awaiting action, which number had increased to 18,540 on January 1, 1908. In previous years it has been customary for the examiners to make special efforts to reduce the number of applications awaiting action at the close of the year, in order that as favorable a showing as possible could be made in the annual report, but, to quote from Commissioner Moore's report: "Their efforts . . . simply resulted in thousands of actions being made which were nothing more than frivolous. After one of these annual efforts, it was necessary to do a greater portion of that work all over again, and it really had the effect of throwing the business of examination of applications further back than ever. This resulted not only in vexatious delays to the inventors, but it caused hundreds of complaints to be filed, and what was still more embarrassing and serious, a great many applications were passed to issue that were not ready for patent, with the result that the inventors and owners of meritorious inventions forfeited valuable rights by these careless, ill-considered, and hasty actions on the part of the office. The inventors are entitled to be protected as well as the public, and they should also be helped by the office in all legitimate ways."

In order to cope with this situation, two important remedies are suggested, and their adoption is forcefully urged. One of these is a large increase in the size of the working force, and the other is an increase in salary for the examining corps.

In the last eight years the number of letters patent, design and reissue patents granted, and trade marks, labels, and prints registered, has increased 73.6 per cent, while the number of employees has increased but 27.8 per cent. This speaks for itself, and therefore the Commissioner's request for an increase of forty-nine examiners and a large number of clerks does not appear unreasonable, but very conservative. With this force the work could probably be not only brought up to date, but the much-needed work of reclassification of the patents could be taken up where it was dropped some time ago for lack of men. With the proper force, an inventor should know within thirty days after his application is filed whether or not he is to receive a patent.

The Patent Office has suffered not only from an inadequate force as regards numbers, but has also suffered from the inability to retain competent men on the examining corps, due to the very low salaries provided by Congress. At present, the Principal Examiners receive but $2,500 a year, a salary fixed by the Act of 1848, at which time the Principal Examiners were placed on the same footing in regard to salary as United States district judges and members of Congress. The failure to pay adequate salaries has resulted in the resignation of nearly fifty per cent of the examining corps in a period of less than five years, and the Civil Service Commission have experienced considerable difficulty in securing eligibles to fill the vacancies created. The examiners are supposed to be graduates of colleges or technical schools, well grounded in physics, chemistry, higher mathematics, technics, French, German, and reading and describing mechanical drawings; but the entrance salary of $1,200 a year, with a maximum limit of $2,500 a year, does not appeal to men having the proper qualifications. Every person passing the civil service examination for this position in the past several years has been appointed, and even then there were often vacancies with no eligibles to fill them. A large percentage of those who have taken the examination and been appointed have merely looked upon the Patent Office as a post-graduate school for gaining further technical and legal education preparatory to entering a professional career. To induce competent men to enter the service, and to retain those already in the corps, the recommendation is made that the entrance salary be raised from $1,200 to $1,500, and the salary for Principal Examiners be $3,000 instead of $2,500.

One of the most important parts of the Commissioner's report is in regard to appeals. Under the present law a series of appeals may be taken; first from the Principal Examiner to the Board of Examiners-in-Chief; thence to the Commissioner; and from his decision to the Court of Appeals of the District of Columbia. Thus three successive appeals are necessary in order to reach the court for a final adjudication of the question at issue, each of which appeals is accompanied by a government fee, and each of which ordinarily costs the inventor an additional attorney's fee. The Board of Examiners-in-Chief is composed of three members, one of whom is often absent, and as no provision is made to supply a temporary vacancy caused by sickness or other reason, cases are often heard by two members, and the result is often an evenly divided board. The Commissioner proposes that a new Board of Appeals be established, to be composed of the three members of the present Board of Examiners-in-Chief, together with the Commissioner and the Assistant Commissioner, any three of whom shall constitute a quorum. An appeal could be taken from the Principal Examiner or the Examiner of Interferences to this Board of Appeals, and thence directly to the Court of Appeals of the District of Columbia, thus eliminating one appeal and its accompanying expense and delay, without curtailing in any way the rights of the inventor. Furthermore, having but one appellate tribunal in the office in lieu of two, would naturally tend to give greater stability to the decisions of the office. The proposed change would, of course, apply to trade marks and interferences, as well as to patents. The Commissioner accompanies the report by two appendices, including the proposed changes to the Patent Law and the Trade Mark Law. Among other changes which the Commissioner proposes is the providing of a complete set of the approximately 3,000,000 foreign patents on file, so that they will be available for searches by manufacturers, attorneys, and inventors. The value of this can hardly be overestimated.

We can see no possible reason why Congress should not grant the increase in force and salary requested, as it should be remembered that the Patent Office is a self-supporting institution, and the object should be, not to make money and accumulate a surplus in the United States Treasury, as has been done every single year since 1861, but to give manufacturers and inventors full value for their money and to increase the value of the office to its maximum extent.

THE PACIFIC SCIENTIFIC INSTITUTION OF HONOLULU.

William Alanson Bryan, for several years curator of the Department of Natural History at the Bernice Pauahi Bishop Museum at Honolulu, H. I., has formed a plan whereby the resources of individuals and institutions will be combined to further the interests of science. The plan has received the support of many men of science and affairs, the result being the incorporation of the Pacific Scientific Institution, upon which $400,000 is to be expended at once, and an equal amount each year for fifteen years. Zoological gardens, biological gardens, botanical gardens, with administrative and library buildings in Honolulu, are to be established; and a suitable vessel is to be equipped for exploring cruises to each group of islands in the Pacific Ocean, of which a complete biological and ethnographical survey is to be made. The necessity of making such a survey quickly, before the progress of civilization renders it impossible, is clearly recognized. Hitherto, the magnitude of the work and the distribution of the islands of the Pacific Ocean among several nations have prevented the concentration of the scientific resources of any one nation upon the task. It is estimated that about fifteen years will be required for the accomplishment of the work in the thorough manner desired. The total cost will thus amount to $6,400,000.

INTERNATIONAL INVESTIGATION OF THE UPPER AIR.

During the year just closed the International Commission for Scientific Aeronautics conducted an extended series of observations of the upper atmosphere. In July simultaneous tests were carried out in many countries, both at meteorological observatories and at many other points. In addition many tests were made at sea, warships being sent out by the governments of France, Italy, Russia, and Germany. Russia took a leading part, experiments being made by her from fifteen stations, including one in the China Sea to which a special expedition was dispatched. Private meteorologists took part in the work; among the sea stations, the Prince of Monaco operated from Spitzbergen; while the well-known French aeronaut, M. de Bort, in conjunction with Mr. Rotch, of the Blue Hills Observatory, arranged an expedition to the seas south of the Azores.

The records are obtained by means of self-recording instruments for measuring height, humidity, and temperature. For moderate altitudes these are raised in calm weather by means of captive balloons, or when the wind is sufficiently strong, by kites. For higher altitudes *ballons sondes*, or sounding balloons, are used. A *ballon sonde* is a small balloon, usually of India rubber. These are free balloons and a number of them go astray, especially those dispatched from observatories near the seacoast. Wind is noted by means of small pilot balloons; their drift being followed with theodolites.

The full data of the records obtained will not be available for some time. Many successful ascents were made, a number of *ballons sondes* reaching a height exceeding 20,000 meters, or about 12½ miles; while the highest one ascended nearly 14 miles.

It is found that, on the whole, temperature decreases with height until a point is reached which has been named the isothermal zone, beyond which the variations are slight, with little if any diminution of temperature up to the highest point reached.

During the July observations freezing point was met with at a height of about two miles, and the isothermal zone with a temperature of from 60 deg. to 80 deg. below zero F. at a height of about 7½ miles.

During 1908 ascents will be made on the first Thursday of each month, and on three consecutive days each quarter. In addition it is proposed to repeat the special week of experiments, and this will probably be done, as in 1907, at the end of July. The meteorological observatories of the United States will assist, as well as a number of European countries. It is hoped that both war and private vessels will again be commissioned to observe and that the experiments will be on a wider scale than those of 1907.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1673, opens with a most interesting article on the preservation of the temples of Angkor. An archæological article is also contributed by R. M. Dawkins, who writes on the excavations of the British school at Athens. Mathematical prodigies are discussed by G. A. Miller. Dr. G. M. Gould traces the origin of right-handedness and left-handedness. A device which rapidly and automatically covers a fire without opening a door is described under the title "A Mechanical Shovel for Boilers." H. Addison Johnston writes on a new type of internal combustion motor, which will run on kerosene or crude oil. How acetylene may be used for army signaling at night is told by Capt. L. D. Wildman. Full instructions for mending cast iron or for welding are given under the title "Brazing Fluxes." The possibilities of the uses of clinker as a basis for concrete have been demonstrated in an interesting experiment by the city of Liverpool. This experiment is described by the English correspondent of the SCIENTIFIC AMERICAN. W. H. Booth contributes an appeal for the safeguarding of machinery. The chemistry of high explosives involves some of the most important laws and principles of chemistry. The composition of most of these high explosives is given by Augustus Klock. Prof. Wilhelm Ostwald, one of the most distinguished chemists in the world, contributes a most interesting article on catalysis. A gas-electric car for railway service recently made its appearance in New York State. This departure is described and illustrated. The "Stream of Planetoids" is the title of a paper by Dr. Julius Franz, in which it is sought to lay down a general law for the location of these numerous bodies.

It is estimated that South America furnishes about 63 per cent of the world's supply of India rubber.

A UNIQUE AERIAL TRAMWAY USED IN THE CONSTRUCTION OF CHICAGO'S LAKE TUNNEL.

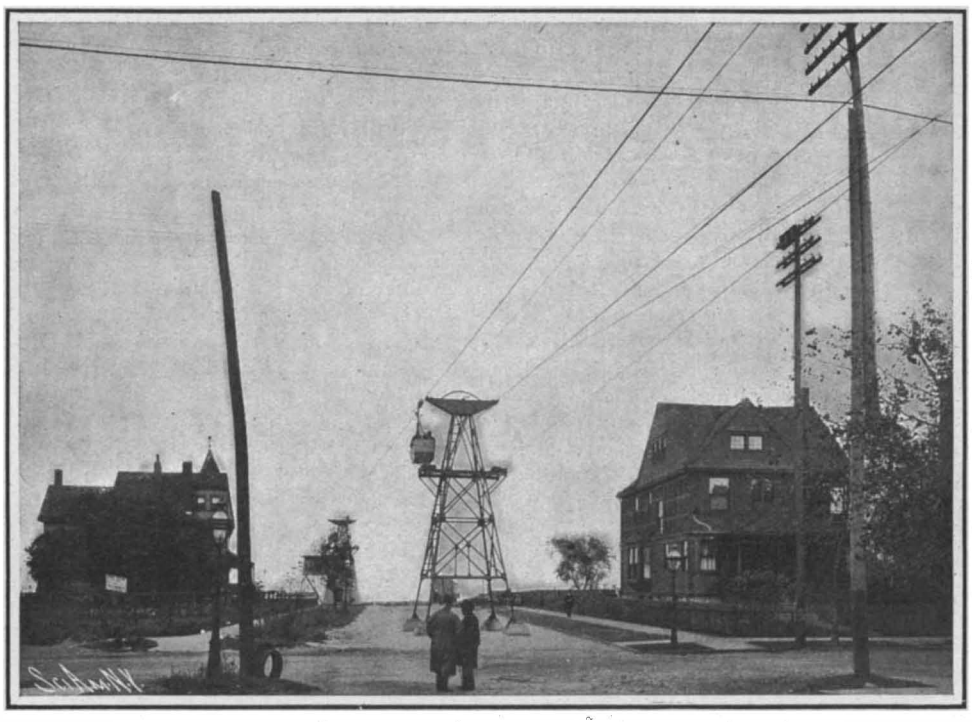
A series of lattice-like towers supporting a cableway stretching out into Lake Michigan for a distance of 8,000 feet from the foot of Seventy-third Street, Chicago, has of late aroused considerable curiosity. The cableway was built for transporting men and materials to and from the intermediate crib of the Southwest Land and Lake Tunnel—a part of Chicago's water-supply system. Such a cableway is an absolute necessity at this time of the year, as it is impossible to land scows at the crib, owing to the rough weather on the lake. The towers, of which there are twenty-six, are spaced at intervals of 300 to 250 feet, and are constructed of steel. Each tower is 35 feet high, and is supported on four steel piles driven in water varying from 10 to 33 feet in depth.

Electric power is employed for operating the tramway, a 25-horse-power alternating-current electric motor being used for driving the trolley system. This motor has a speed of 600 revolutions per minute, and about half of its maximum power is used when the tramway is operated under normal conditions. A large drive wheel is geared to this motor, and carries the cable. A 1⅜-inch wire carrying cable and a ⅞-inch traction cable are used, the former being of a special flat strand, which allows the buckets to ride easily.

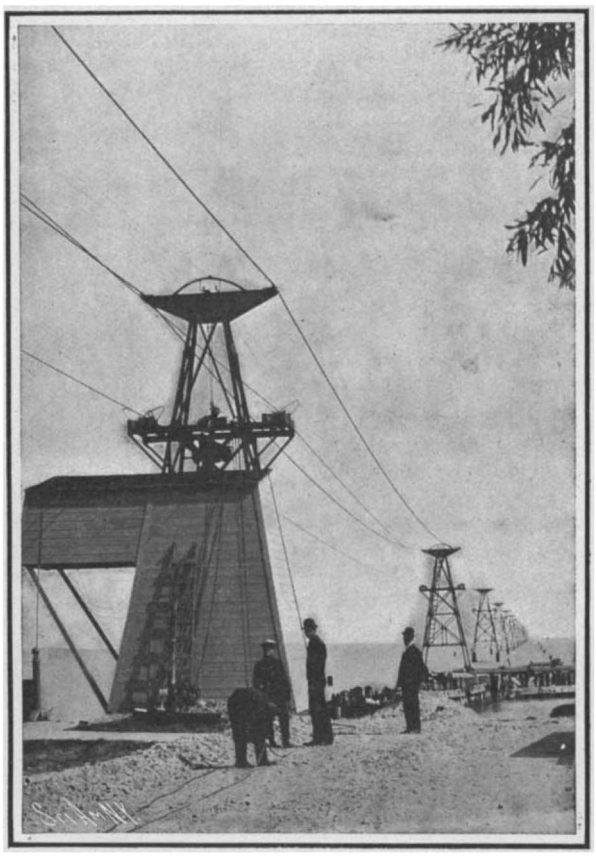
Steel tramway buckets are used, each carrying about half a ton, the working capacity being 10 cubic feet, with two grooved pulleys 16 inches in diameter, running in tandem on the carrying cable and hauled by the traction cable. The speed of the cable is approximately 350 feet per minute, and it takes the buckets twenty-three minutes to reach the crib. The buckets are spaced 300 feet apart, and are automatically connected to the cable as they go out, and similarly released as they reach the terminal. The capacity of the cableway is 400 cubic yards of material every ten hours. A compressed air pipe is also supported on a separate cable.

The passenger car used on this tramway is 3¼ feet wide and 5 feet high, the oval body being 4 feet long. It will seat four workmen. One of the accompanying illustrations shows the design and construction of the car.

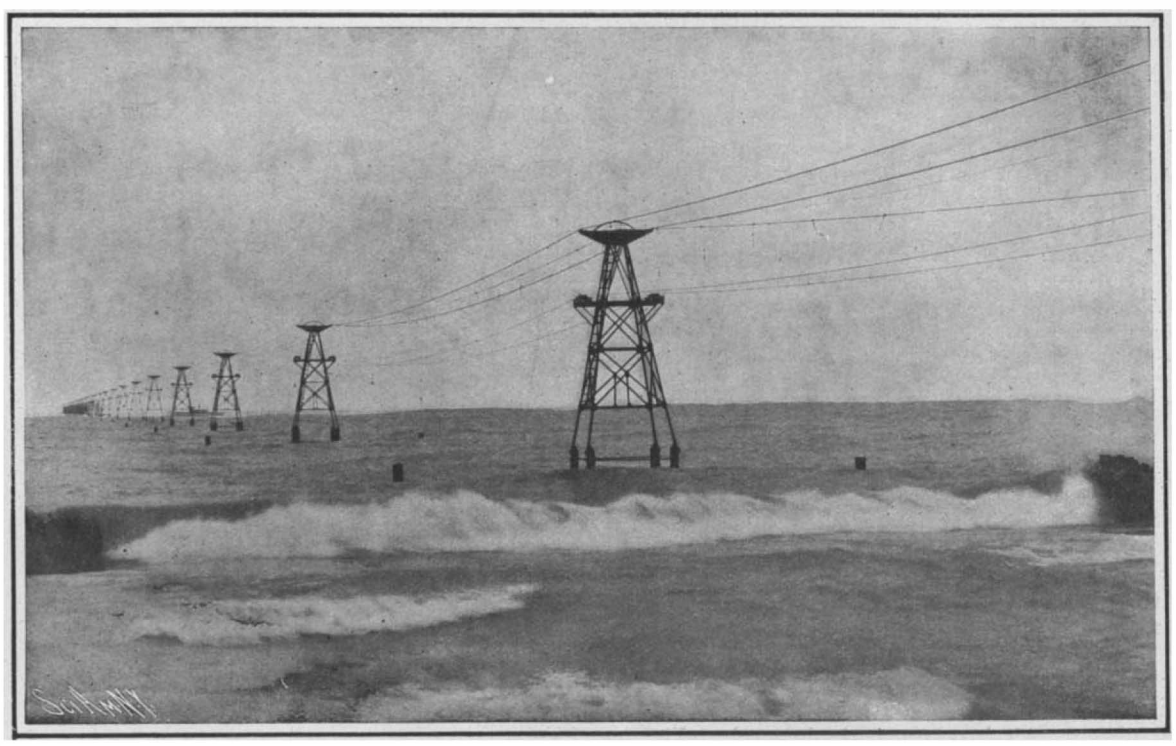
In order to prevent danger to shipping on the lake, anchor lights, as called for by the United States marine laws, are placed on each tower of the tramway. In addition, the towers are provided with two incandescent lamps of 64 candle-power each, and a searchlight of 18,000 candle-power is played on the line of towers nightly from shore.



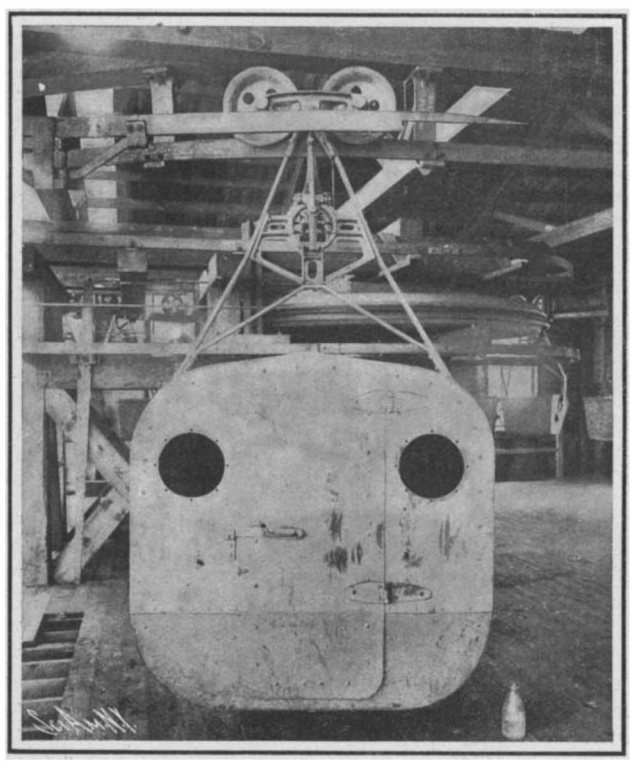
The Aerial Tramway Running Through One of Chicago's Streets.



Shore Tower of the Aerial Tramway.



The Cableway Stretching Out Over the Lake for a Distance of 8,000 Feet.



The Passenger Car Used on the Cableway.

A UNIQUE AERIAL TRAMWAY USED IN THE CONSTRUCTION OF CHICAGO'S LAKE TUNNEL.

Paper making in Japan has been very active for the past year or so. New companies have been formed, and old ones enlarged. Most Japanese mills use steam for motive power, and nearly all the machinery used is of American make.

Memorial Service for Lord Kelvin.

A service in memory of Lord Kelvin was held on Sunday, January 12, in the Engineers' Building, New York. Tribute was paid by a number of speakers to his many-sided genius; and his definite religious conviction and the sturdy practicalness of his work were emphasized. Speaking of Lord Kelvin as an electrical engineer, Prof. Thomson declared that his life was a standing rebuke to those who affect to find a superior merit in working for pure science over working for practical results. Nothing could be less sordid, he declared, than Kelvin's desire to achieve practical results. "To him there was just as much romance and sublimity in founding great communities, in making real additions to the wealth of the world, in extinguishing the smoke of railroads, and in lighting towns hundreds of miles away as in a mass of water falling over a precipice. In the daytime there may be many elements of sublimity in Niagara, but remember the falls go on unseen at night or when they are obscured by fog and mist."

When Cyrus Field was pondering over the question of a transatlantic cable, there were many people who could give an opinion, but Lord Kelvin—William Thomson, as he then was—was the only man who would give a definite affirmative answer. And he lent practical aid until communication was established between Britain and the United States.

The Dangers of Celluloid.

Evidence is not wanting that celluloid is a very dangerous material and its increasing use in the arts and manufactures suggests that the storage of this extremely inflammable substance should be placed under stricter conditions of control than are apparently required at present. A short time ago a serious fire occurred at a factory in Walton-on-Thames in which celluloid was employed for the preparation of kinematograph films. Apparently the fire was started by a film igniting in some way not satisfactorily cleared up, but the ignition of this film was sufficient to involve very rapidly the entire factory in flames. One factory hand failed to make his escape and perished. In the evidence at the coroner's inquiry it was stated that there were no less than 27 miles of celluloid film on the premises at the time of the fire. In spite of the precaution of keeping this very large stock of highly inflammable material distributed in a large number of tins it is quite evident that if fire had reached them an enormous conflagration, if not explosion, would have ensued. As a matter of fact, in the present case, owing to the promptitude and efficiency of the fire brigade, more serious consequences were averted. The existence of such a place in the midst of an inhabited area might surely give rise to well-founded apprehensions as to the risks to which the storage of celluloid on this scale might expose the neighborhood.—The Lancet.

A report from Montreal states that the establishment of pensions on an unexpectedly liberal scale by the Grand Trunk Railway is hailed with delight on the part of the workmen of the company. The decision also means the immediate retirement of 200 aged workmen who will be able to pass the rest of their lives without work.

A PHOTOGRAPHIC METHOD OF PRODUCING BAS-RELIEFS.

BY DR. ALFRED GRADENWITZ.

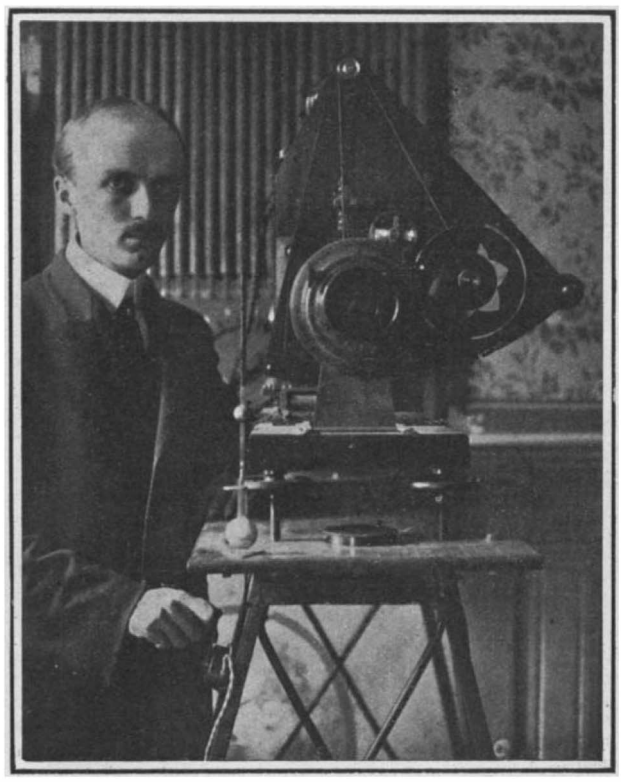
Hitherto photography has been used both in competition with and as an aid to the artist in reproducing life on a flat surface, but a recent development indicates that it will soon invade the field of plastic art. Endeavors to extend the scope of photography to a third dimension date from the earliest days of photography. In fact, as far back as in 1861 M. Willème, a Parisian sculptor, designed a half mechanical, half photographic process for reproducing the plastic form of a model. This process consisted in photographing the model from all sides with a number of cameras, and then using the photographic records to reconstruct the model, probably with the aid of some mechanical drawing apparatus or pantograph. This process soon fell into oblivion because it depended too much upon the skill of the sculptor, and hence hardly deserves the name "photo-sculpture" chosen by its inventor.

Portrait Produced in Bas-Relief by the Photo-sculpture Process.

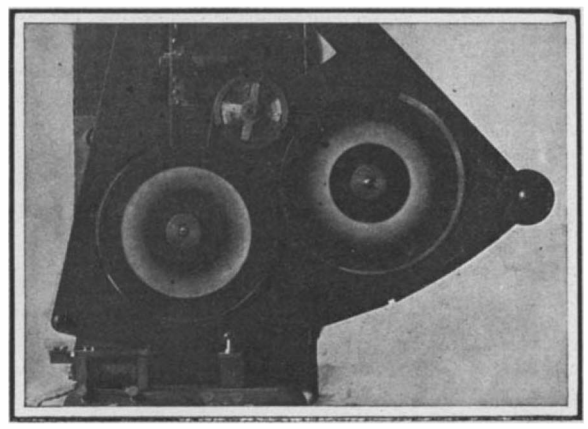
Toward the end of last century Selke inaugurated an improvement by substituting for the ordinary photographic camera a biographic apparatus. A shadow gradually progressing in the direction of the latter was projected on the model and the apparatus thus recorded quite a number of silhouettes corresponding to as many parallel cross-sections of the model. These negative records (about 500 in number) were next magnified separately on bromide paper and each of the magnified prints was pasted on cardboard and cut out with scissors, in order by a clever combination of silhouettes to reproduce the relief of the original model. The difficulties inherent to this process, which likewise depended on the operator's art far more than on photography, are too apparent to need being dwelt upon.

Among authorities in the art of photography it has long been held that to reproduce the plastic form of a model by photographic means alone is indeed a hopeless task. And yet the chief element which enters into the present solution of the problem was found many decades ago, in the discovery that a certain gelatine made sensitive to light by the addition of bichromate when immersed in water will lose its capacity of swelling in a measure corresponding to the intensity of its illumination. This phenomenon at first sight would seem immediately to afford a solution of the problem, as the substance in question produces of its own accord a relief, whose depth depends exclusively on light intensity. In fact, a negative plate allows all grades of light intensity to be produced, so that a relief of any desired depth can be obtained. However, such a plate, in order to achieve this result, should be more or less transparent, according as the corresponding portions of the model are more or less in relief, and ordinary photographic negatives do not comply with this condition. There are, in fact, two disturbing factors; for one thing color is bound to exert some influence on the photographic record, so that surfaces in the same plane will come out with different intensities according to their tint. On the other hand, the light effects of an ordinary photograph depend chiefly on the angle of incidence upon the different parts of the model. The same beam of light which, when striking a surface at right angles illuminates an area of say 1 square inch, obviously lights up a far greater surface when arriving at an angle, and as the same amount of light is used for illuminating surfaces of different size, the intensity of the illumination must vary as the size (and hence the inclination) of the surface.

These difficulties, which seemed insurmountable, have been overcome by an Italian engineer, Signor Carlo Baese. If in a stereopticon a colored glass prism or wedge of small angle be inserted, the thicker portions will absorb a greater amount of light, and the thinner portions will allow more light to pass. This graduated illumination is made to strike the model to be reproduced in the shape of a plastic photograph. If the model be photographed with this illumination, owing to the two disturbing factors just mentioned (that is the color and inclination of the surfaces) the gradations produced by the wedge will be practically lost. If, however, another negative be taken after inverting the glass prism and accordingly the direction of this gradation, those portions which formerly had been struck by the strongest light will now be in a half-shadow, while the remaining portions will be more intensely illuminated. However, this second negative will for the same two reasons fail to show gradation of the prism. Now it will be noticed, that the two negatives, while comprising the given light gradation in opposed directions, are affected by the two disturbing factors in accurately the same sense. Again, as is well known, a photographic print will be darker, as the corresponding points of the negative plate are brighter or more transparent.



About to Make an Exposure Through One of the Revolving Disks.



Revolving Disks Used to Intercept the Light.

Portrait Produced in Bas-Relief by the Photo-sculpture Process.

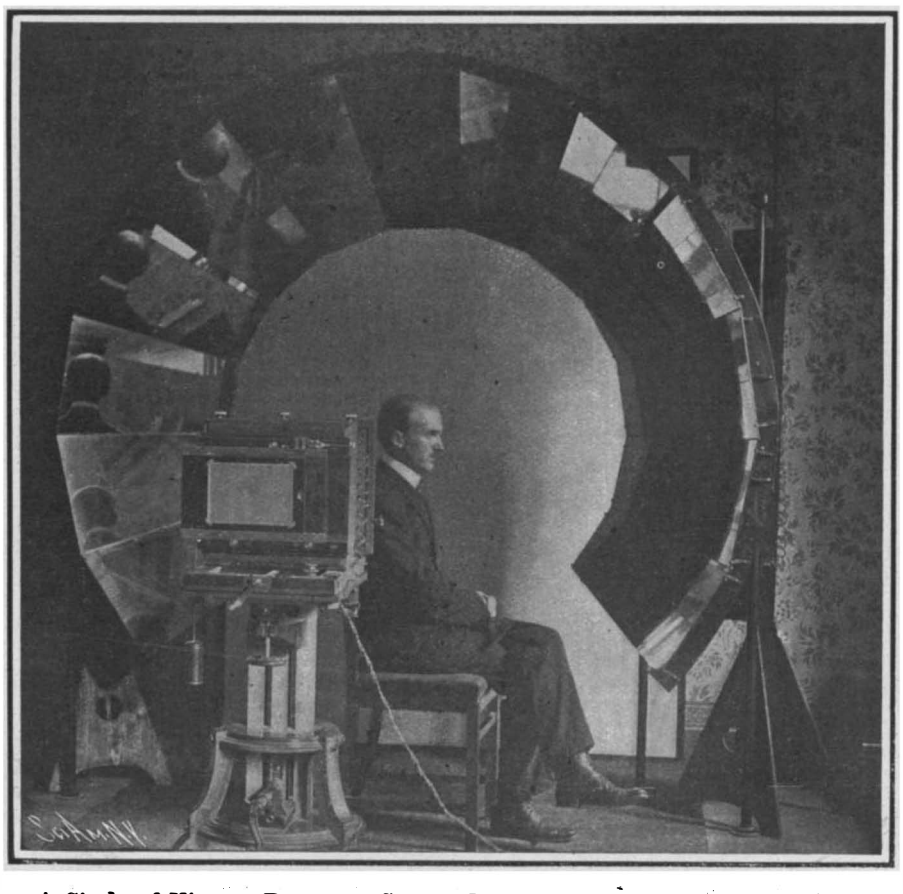
These facts are utilized by Baese in making from one of the two negatives a positive glass print, which obviously is the reverse of the original negative, both as regards light gradations due to the glass wedge and the disturbing factors which are above referred to. Whereas the two negatives had reversed light gradations and identical defects, the positive plate shows the same light gradations and reverse defects. The two plates can obviously be placed one above the other so as to accurately register. When inspecting this combined picture as a transparency its capacities will be seen to be added, while the defects due to the two disturbing factors are accurately compensated. The combined picture (which for all practical purposes can be regarded as a single picture) now complies with the requirements that its transparency vary directly with the relief of the model and independently of the color and inclination of its surfaces. It can accordingly be utilized for obtaining photographic bas-reliefs on a bichromate gelatine plate.

When the gelatine is exposed below the combined plate, the relief forms very rapidly. As soon as a sufficient relief is obtained, the process is discontinued, when the model can be used for manifolding by any of the well known mechanical or electro-chemical processes. Instead of exposing the whole model at the same time it may be illuminated in sections, reproducing each to a given depth of relief, viz., about one-half inch. A convenient combination of the reliefs corresponding to the various portions of a model obviously allows greatly increased effects to be obtained, the aggregate depth of relief being as many times one-half inch as there are sections separately formed.

While the above description embodies the principle of Baese's invention, the system represented in the accompanying figures is a decided improvement on the original experimental arrangement. Instead of using a colored glass prism, the light gradation is obtained more efficiently by the aid of a rotating disk, out of which there is cut an aperture bordered by a peculiar curve for intercepting the light required for the desired gradation, the opposite gradation being secured with a similar disk showing an inverted curve.

Then, instead of directly striking the model, the light generated by a single electric arc lamp is reflected on the latter by a system of mirrors arranged in a circle, the model, situated in the center of this circle, being lighted with an intensity about thirteen times that of a single lamp. As this intensity always remains the same, and as the plates have always the same sensitiveness, a standard exposure of about 5 seconds can be made, thus eliminating any chances of failure as in ordinary photographic work.

As regards the possible applications of this method of "photo-sculpture," as it is rightly called, it should be understood that it is by no means intended to become a competitor but rather a valuable aid to the real artist, like ordinary photography, which has become so indispensable to both the painter and sculptor. It may further be used for reproducing the original work of the artist in an economical manner, with a practically perfect



A Circle of Mirrors Focuses a Strong Light Upon the Subject Which is to be Reproduced.

A PHOTOGRAPHIC METHOD OF PRODUCING BAS-RELIEFS.

truthfulness and to any desired scale. On the other hand, photo-sculpture will allow plastic portraits to be obtained with all their details. The accompanying illustrations of portraits produced by the photo-sculpture process will give an idea of the possibilities of Baese's method.

Many art industries, such as those producing medals, cameos, brooches, and any other plastic objects from leather, paper, porcelain, terra cotta, etc., will likewise derive great benefit from this ingenious and inexpensive process.

The Beck Isostigmar—A New Photographic Lens.

Some years ago the development of photographic lenses reached a point as near perfection as could be attained with the glass at that time available. Then, as the result of a very thorough series of experiments in glass making, a number of new kinds of glass of different refractive powers were produced at Jena, and enabled opticians to extend widely the capabilities of their lenses. The modern "anastigmat," which gives a sharply-defined undistorted image at or near the margins of the field which it covers, became possible, and was developed by many firms. The wide variety of new glasses available made it feasible to correct the faults of the older types of lenses by various methods; and many anastigmatic lenses were designed and patented by different firms, all attaining to similar results, though not necessarily by the same combinations of glasses or lenses.

The addition of another to the long list of anastigmats is not in itself a matter for comment. The "Isostigmar" invented by Beck is, however, unusual, in that it has been evolved by departing from some of the accepted laws of lens making, and that it gives new power to the photographer in a direction where he has long needed it.

It has long been recognized by lens makers that in order to produce a lens which will give a flat field, free from astigmation, what is known as the "Petzval condition" must be observed. Perhaps the simplest statement of this condition is that the sum of the focal powers of the individual *surfaces*, when divided by the product of the refractive indices on either side of the surface, should be zero. To obtain absolutely perfect correction over a small field, this condition must be satisfied. The makers of this new lens have not taken the Petzval condition into consideration, but proceeding along lines of trial and correction, have gradually produced a lens which, while violating theory, has proved a practical advance. The advantage of the "Isostigmar" is that it gives a flat field over a very wide angle, although, according to Petzval's condition, it should show a large error. In a lens covering an angle of 70 deg., theory says that on the margins of a plate the image given by the "Isostigmar" should be half an inch in front of the plate, whereas in fact it is barely one-fiftieth of an inch away, or for practical purposes in sharp focus. With this flatness of field it would seem to be unnecessary to stop down the lens for wide-angle work, as is at present done. Whereas at present many lenses covering an angle of 90 deg. work at *f*/16 or *f*/22, or occasionally as wide open as *f*/12, this new lens may be used without stopping down. A wide-angle lens which will give a crisp negative of architectural subjects when working at *f*/6.3 will prove a most useful addition to the powers of the photographer.

Interest in Safety Devices.

Great interest was awakened in the American Museum of Safety Devices at a dinner given in New York, January 15, in honor of the conferring of decorations by the French government. The fortunate members of the museum's board to be so highly honored were Mr. Charles Kirchoff, editor of the Iron Age and Chairman of the Committee of Direction; Mr. T. Commerford Martin, editor of the Electrical World and Vice-Chairman of the same committee; and the Rev. Percy Stickney Grant, rector of the Church of the Ascension. These gentlemen are of the highest professional standing, so that it is of interest to know that this honor was conferred for their labors for humanity rather than for their intellectual attainments. The presiding officer was the Hon. Elbert H. Gary, chairman of the United States Steel Corporation, and the other speakers were the Rt. Rev. Henry C. Potter, Mr. John La Farge, Mr. W. D. Dickson, Dr. W. H. Tolman, and Dr. Josiah Strong. There were about 250 gathered to greet the three guests of honor, who were presented by their sponsors, and who replied with appropriate remarks concerning the brave war which they and their associates are waging against industrial accident and disease. Some of the figures mentioned were really appalling. Over fifty per cent more lives are lost in America by accident, each year, than were lost in the Russo-Japanese war. Dr. Strong stated that in the years 1900 to 1904, 80,000 more lives were lost in this country through accidents than in the whole course of the civil war, including the casualties on both sides. Mr. Martin called attention to the fact that the museum was now being rapidly put into shape, and that a part of it had been set aside as an inventor's laboratory, where penniless inventors might work out their safety devices under the protection of the museum. Gilded bronze replicas of the Scientific American medal were passed around for inspection. The field of this "grand prix" has been limited to that of transportation the first year, and the medal will be awarded for the best device that has appeared or will appear between January 1, 1906, and December 31, 1908. The jury of award is composed of men of international reputation and includes Messrs. Stuyvesant Fish, George Gilmour, John Hays Hammond, Frederic R. Hutton, Samuel Sheldon, Herman H. Westinghouse, and Cornelius Vanderbilt. That the work of these gentlemen will be most painstaking and their findings most just is of course assured. It is pleasant to know that this great humanitarian movement is being backed by men of the highest attainments and in control of some of the largest industries in the world. Surely the wage earner is fortunate in having such powerful allies. From a small beginning the museum is destined to be a power against the often preventable accident, which is an economic calamity.

Aeronautical Notes.

The Scientific American Trophy for heavier-than-air flying machines will be shortly placed on exhibition in the show window of Messrs. Reed & Barton, Fifth Avenue corner Thirty-second Street.

When the bids for the proposed new army dirigible were opened by Gen. Allen, the chief signal officer, at Washington on the 15th instant, the proposals, which were six in number, were found to be as follows: Carl E. Myers, Frankfort, N. Y., $9,996; 120 days for delivery. Charles J. Strobel, Toledo, Ohio, $8,000; 120 days. William Reiferscheid, Streator, Ill., $5,000; 150 days. Harry B. Schiller, Philadelphia, Pa., $25,000; 120 days. A. W. Cracy, Washington, D. C., $12,500; 90 days. John Kairies, Mt. Vernon, N. Y., $10,000 to $15,000; no time specified. For an airship capable of making 40 miles an hour, Mr. Kairies bid $25,000 to $30,000. Mr. H. H. Curtis, Hammondsport, N. Y., also submitted a bid, but it arrived a day late. But three of these seven bidders furnished the certified check for 15 per cent of the price asked, as required by the War Department, while but two of the three, Messrs. Myers and Strobel, are men who have had much practical experience in the construction of airships.

M. Henri Deutsch's airship "Ville de Paris" was placed at the disposal of the French government immediately after the loss of "La Patrie," and recently, on January 15, it flew from Paris to Verdun, a distance of about 140 miles, in 9 hours time, or at an average speed of 17 to 18 miles an hour, if an hour is deducted for a stop made to effect repairs to the machinery. The first attempt to fly to Verdun was made the day before Christmas, but on account of a strong wind, which was dead against the airship, a speed of only 10 miles an hour was obtained, and the new military dirigible was obliged to return to its shed.

It is likely that the "Lebaudy," the original airship built by Engineer Julliot, and now located at the Chalais-Meudon Aerostatic Establishment, will be put in service in order to replace the "Patrie," and it will be able to render the same services as the latter. The construction of new airships of the "Lebaudy" series is now being actively taken up. Georges Juchmes, who has already commenced work at the Moisson establishment upon the new airship "République," which is of the same type as the "Patrie" and built after the designs of M. Julliot, stated to our correspondent that the "République" does not differ from the former airship except in some improvements in detail, such as some changes in the form of the balloon body and in the arrangement of the plane surfaces. The new airship will have a capacity of 3,600 cubic meters (127,121 cubic feet) and will be equipped with a 70-horse-power motor. The speed and the net load carried on the new model will be greater than in the former case. It is expected to have it finished before next May and even as early as next February.

Natural Ice Making in the Tropics—The Peculiar "Ice Farms" of Hot Bengal.

BY L. LODIAN.

In hot India, where every day in the year the resident gets all the heat he wants, there are four or five months of the year—November to March—when the nights, although never reaching even to frostiness, can be made to produce many tons of ice in the open.

The fields in which the ice is made are low, flat, and open, and the ice is produced in large lots when the temperature of the air is 15 deg. or 20 deg. F. above the congealing point. The method practised is an instructive example of keen observation adapted to material purposes by a nation which is to-day ignorant of the science of the thing; that is, they could not explain, if questioned, what actually causes the forming of the ice, beyond a few vague phrases like "the wind," and "keeping the earthly heat down." Yet this same ice-forming process has been utilized in Indasia since the ages that are "lost in the night of time," and all with a scientific observation and accuracy which the Hindu has acquired by instinct handed down thorough countless generations, but which (as just observed) he is unable to elucidate to a questioning investigator.

The following method is adopted by the Ganges wallas (native coolies) for making ice in the region of the Hugli, near Kalikata, in fields composed of a black loam soil upon a stratum of sand.

The ice plot is a rectangular piece of ground, say 130 feet long by 30 broad, running in an easterly and westerly direction. The soil is removed to a depth of a couple of feet. This excavation, when made, is smoothed, and then allowed to remain exposed to the torrid rays of the sun to dry. Then rice straw in small sheaves is laid in an oblique direction in the hollow (with loose straw upon the top) to the depth of a foot and a half, leaving its surface half a foot below that of the ground.

Numerous beds of this kind are formed (the ensemble constituting the "ice farms"), with narrow sidewalks between them, in which here and there large covered earthen water jars are sunk in the ground for the convenience of having water near by to fill the shallow unglazed earthen vessels in which it is to be frozen. These dishes are 9 inches in diameter at the top, diminishing to 5 inches at the bottom, 1½ inches deep, and ¼ inch thick, and are so porous as to soon become moist throughout when water is placed in them.

During the day, the loose straw in the beds above the sheaves is occasionally turned over, in order that the lot may be maintained in a desiccated state; and the water receptacles between the beds are replenished with soft pure water from the nearby springs. When evening comes, the shallow earthenware pans are placed in rows upon the litter; and, by means of little burnt-tile pots secured to the ends of lengthy bambusa canes, each pan is half filled with water. The quantity, nevertheless, varies according to the expectation of ice; the natives can forecast that by the aspect of the heavens, and the evenness with which the air currents come from the northwest. When favorable, about half a pound of water is put into each little dish or plate; but when less ice is expected, about a quarter pound of water is the usual amount; but, in any case, more water is put into the dishes nearest the west end of the beds, as the yield there is always a trifle bigger.

There are about 5,000 plates in each of the beds, and the ice yield will average, say, ¼ pound from each dish.

In the cool season, when the temperature of the air at the ice fields is under 50 deg. F., and there are gentle breezes from the north and west directions, ice appears in a night in all of the shallow pans. Native watchers are on the lookout to note when a thin film appears on the water in the pans, when the contents of several are mixed together, and sprinkled over the other dishes. This method augments the freezing action. Stagnation has been discovered by the natives to diminish the quantity of ice produced. When the firmament is entirely clear, with zephyr currents from the northwest, the congelation begins before or about midnight, and continues to advance till morning, when the thickest ice is formed. It is often an inch thick, and sometimes the whole contents of the dish are frozen compact.

The ice dishes present a large moist external surface to the air currents, producing rapid evaporation and a lowering of the temperature. The water which percolates through the porous trays exposes so large a surface to the breeze that it is promptly frozen. In addition to the evaporative effect we also have the influence of heat insulation to fall back upon in explaining the phenomenon.

The thick layer of dry straw in the ice beds forms a large surface, which is a poor conductor of heat. The heat can penetrate but a little way into it during the day. So soon as the sun sets, this large and powerfully radiating surface is brought into action, and affects the water in the thin, porous pans, themselves strong radiators.

Some of the natural-ice "farms" of Bengal produce in a single night over ten tons of ice, employing 300 persons of all sizes and ages; and the early morning harvesting of the ice by these lithe gentry darting about, is one of the few animated scenes worth noting in the Ganges region.

The above observations were made by the writer on the spot during journeyings in the Ganges delta over a dozen years ago; and for wide extended and exhaustive data on the subject, with elaborate temperature charts, the reader may refer to the Journal of the Asiatic Society (Kalikata: the Institute), Vol. 2, p. 80 etc.; also to the painstaking papers of Dr. Wise, surgeon-general, British army (idem.) Up to a few years ago, this method formed the main ice-supply of Bengal; but the introduction of modern ice-producing plants has largely relegated the industry to purely local requirements. Some sections of our southwestern States, remote from ice-plants, might during a certain period of the year be found suitable for this natural-ice production.

Correspondence.

Sprinklers in Large Buildings.

To the Editor of the SCIENTIFIC AMERICAN:

After reading the article "Winter Fires" in your issue of the 11th instant, will you not kindly give this letter a chance to be criticised by your able fire fighters?

A law should be enacted that every business building be equipped on the ceilings of each floor with perforated pipes running the width of the ceiling and about six feet apart. These pipes to be controlled by a valve at each floor, to be operated by the occupants of the building. At night a valve should be located near a window on first floor for the firemen to reach.

The present automatic sprinklers have the fault that a fire is obliged to reach considerable headway before the heat reaches the sensitive valve.

A large tank on the top floor fitted with chemicals could be very effectively released upon a fire at the start through a similar system of pipes. The saving to the city of fire engines would be materially reduced were such a law in effect. I humbly submit this letter, and court criticism on it from persons who are competent to do so. FREDERIC BRADLEE ABBOT.

Sharon, Mass., January 15, 1908.

A Cause of the Derailment of Trains.

To the Editor of the SCIENTIFIC AMERICAN:

Has it ever occurred to you that the mysterious derailment of trains, of which you speak in the SCIENTIFIC AMERICAN, might be owing to the shortness of the four-wheeled truck frame in almost universal use, as compared with its width upon the track? And this is true of any truck of four wheels *pushed or pulled by or from a center pin or kingbolt.*

To illustrate: Anyone familiar with mechanics knows that a two-wheeled truck moved by the center, whether on rails or a highway, has a tendency to twist itself about, until it may be dragged by its longer axis. In four-wheeled trucks this twisting or swiveling shows itself until the distance between the axles is greater than that between the rails, when real stability begins; and as the axles are moved farther and farther apart, such stability continually increases till in the six-wheeled truck, or the four-wheeled one of equal length, we find the wheels traveling smoothly with little tendency to climb the rail, whether the track be straight or curved.

It will be found that tender trucks are the shortest of all, for they are necessarily more crowded, and they are often much shorter than the distance between the rails, and it is well known that derailment of tender trucks is of more frequent occurrence than that of others, though partly owing no doubt to the light weight of the tender at the end of a long run, when the wheels are not held so firmly to the track. This swiveling tendency becomes very great in rounding curves or changing from one curve quickly to another. There is no doubt that the swiveling or wedging of a short truck may often account for a broken flange, in which case the trouble is ascribed to a broken wheel alone, when the shape of the truck frame itself is directly responsible.

Is not this explanation entitled to credence, in a matter not otherwise capable of explanation?

GEORGE S. PAINE.

Winslow, Me., December 23, 1907.

[It is highly probable that the shortness of the four-wheeled truck has been a contributory cause, if not the actual cause of many derailments. We have always favored a longer wheel-base for trucks. The four-wheeled trucks on European railways are noticeably longer than they are on our roads.—ED.]

Audubon the Original "Nature Faker."

To the Editor of the SCIENTIFIC AMERICAN:

A friend of mine who has a penchant for historic research along the lines of natural science, recently brought to my notice an interesting article on the habits of rattlesnakes by the great naturalist Audubon. This article was published at Philadelphia in 1828 in Vol. ii. of the Journal of the Franklin Institute, edited by Thomas P. Jones, M.D., Superintendent of the Patent Office at Washington and formerly professor of mathematics in the Franklin Institute.

The following is a part of Audubon's essay on the habits of rattlesnakes:

"The power of fascination gratuitously ascribed to most snakes by theoretical naturalists, has so long riveted the attention of all persons inclined to think on the subject, but without the means of judging for themselves, that the following fruits of many years' observation, in countries where snakes abound, will not, I hope, though adverse to the supposed power of fascinating, be looked upon as destitute of interest.

"Rattlesnakes in particular appear to have acquired their chief fame from this supposed charm. I shall, therefore, draw your attention more directly to the habits of that species, and begin by enumerating the many real and extraordinary faculties bestowed upon it. These consist in swiftness; in powers of extension and diminution of almost all their parts; in quickness of sight; in being amphibious; in possessing that wonderful and extraordinary benefit of torpidity during winter, and long-continued abstinence at other periods, without, however, in the meantime losing the venomous faculty, the principal means of their defense. I shall proceed to elucidate, by well-authenticated examples, all those different faculties.

"Rattlesnakes hunt and secure for their prey, with ease, gray squirrels that abound in our woods; therefore they must be possessed of swiftness to obtain them. Having enjoyed the pleasure of beholding such a case in full view in the year 1821, I shall detail its circumstances. Whilst lying on the ground to watch the habits of a bird which was new to me, previous to shooting it, I heard a smart rustling not far from me, and turning my head that way, saw, at the same moment, a gray squirrel full grown, issuing from the thicket, and bouncing off in a straight direction, in leaps of several feet at a time; and not more than twenty feet behind, a rattlesnake of ordinary size pursuing, drawn apparently out to its full length, and sliding over the ground so rapidly, that as they both moved away from me, I was at no loss to observe the snake gain upon the squirrel. The squirrel made for a tree, and ascended to its topmost branches as nimbly as squirrels are known to do. The snake performed the same task considerably more slowly, yet so fast that the squirrel never raised its tail, nor barked, but eyed the enemy as he mounted and approached. When within a few yards, the squirrel leaped to another branch, and the snake followed by stretching out full two-thirds of its body, whilst the remainder held it securely from falling. Passing thus from branch to branch with a rapidity that astonished me, the squirrel went in and out of several holes, but remained in none, knowing well that, wherever its head could enter, the body of his antagonist would follow; and, at last, much exhausted and terrified, took a desperate leap, and came to the earth with legs and tail spread to their utmost to ease the fall. That instant the snake dropped also, and was within a few yards of the squirrel before it had begun to make off. The chase on land again took place, and ere the squirrel could reach another tree, the snake had seized it by the back, near the occiput, and soon rolled itself about it in such a way that, although I heard the cries of the victim, I scarcely saw any portion of its body. So full of its ultimate object was the snake, that it paid no attention to me, and I approached it to see in what manner it would dispose of its prey. A few minutes elapsed, when I saw the reptile loosening gradually and opening its folded coils, until the squirrel was left entirely disengaged, having been killed by suffocation. The snake then raised a few inches of its body from the ground, and passed its head over the dead animal in various ways to assure itself that life had departed; it then took the end of the squirrel's tail, swallowed it gradually, bringing first one, and then the other of the hind legs parallel with it, and sucked with great difficulty, and for some time, at them and the rump of the animal, until its jaws became so expanded, that after this, it swallowed the whole remaining parts with apparent ease.

"This mass of food was removed several inches from the head in the stomach of the snake, and gave it the appearance of a roleau of money brought from both ends of a purse toward its center; for, immediately after the operation of swallowing was completed, the jaws and neck resumed their former appearance. The snake then attempted to move off, but this was next to impossible; when having cut a twig, I went up to it, and tapped it on the head, which it raised, as well as its tail, and began for the first time to rattle. I was satisfied that for some lapse of time it could not remove far, and that the woods being here rather thin, it would soon become the victim of a vulture. I then killed it, and cut it open to see how the squirrel lay within. I had remarked that, after the process of swallowing was completed, singular movements of the whole body had taken place—a kind of going to and fro for a while, not unlike the convulsive motion of a sick animal, as a dog, for instance, about to vomit. I concluded that some internal and necessary operation was going on. This was proved when I found the squirrel lying perfectly smooth, even as to its hair, from its nose to the tip of its tail. I noted all this on the spot. This over, I sought my game again, and felt a great satisfaction; but having met my friend Mr. James Perry, on whose lands in the State of Louisiana I was then hunting, and having related what had just happened, he laughingly said, 'Why, my dear sir, I could have told you this long ago, it being nothing new to me.' These facts, I trust, are quite sufficient to exemplify the faculties of swiftness and the powers of extension and diminution in the rattlesnake. In regard to quickness of sight, I have several times discovered a snake to be near me from a sudden and brisk rustling amongst the dead leaves or grass, as a vulture or forked-tail falcon was passing over the place in search of food, and by close investigation discovered that some snake had made its way to hide under a log, root, or stone, from its winged enemy; for, after being satisfied that the noise thus heard was produced by snakes laboring to escape through fear, I have remained snug and silent, and have seen them issue from their covert when the vulture had gone by. But, further, I have frequently seen them move their heads sideways, looking up to the trees, and discovered that they were then in search of birds' nests; and so watchful of the parent's motions, that, as if afraid to suffer by the encounter with a bird of size and power, they made choice of the time when both parents were absent, to ascend and rob them either of the young or the eggs, if not fully laid and ready for incubation. Should the snake in such attempts be perceived by the owner of the nest, their cries of alarm and attack are heard through the woods, and so many other birds assemble and pour in from all sides, that it becomes nearly impossible for the snakes to make good their retreat. I shall merely add that those battles and defeats are corroborated by one of our most eminent naturalists in America."

In a later number of the Franklin Journal the following notice appears by the editor, Dr. Jones:

"Just as the editor was leaving Philadelphia for Washington, he was pressed for 'more copy' by his printer, and hastily marked some articles for insertion, among which were 'Notes on the Rattlesnake,' by John James Audubon, F.R.S.E., M.W.S., etc. Time did not admit of reading the article, but it was seen that the writer professed to offer the 'fruits of many years' observation, in countries where snakes abound.' This with his titles, and the bold and splendid assurances which we had seen respecting the publication of his works, served as a password to his tissue of falsehoods, which would have been expunged from the proof, but for absence from the press.

"We had determined to publish a notice like the foregoing, when we received a note from a scientific friend, whose remarks are, at once, so pointed and correct, and so fully express our own ideas upon the subject, that we gladly adopt and insert them.

"'It is a tissue of the grossest falsehoods ever attempted to be palmed upon the credulity of mankind, and it is a pity that anything like countenance should be given to it, by republishing it in a respectable journal. The romances of Audubon rival those of Munchausen, Mandeville, or even Mendez de Pinto, in the total want of truth, however short they may fall of them in the amusement they afford.'"

A careful perusal of later numbers of the Journal reveals no reply from Audubon. He was probably too busy with other nature "romances" to reply to his critics.

This is a good illustration of Solomon's wise remark that "there is nothing new under the sun." In this advanced twentieth century we had fondly hoped that the "nature faker" at least was a product of the Rooseveltian age of literature; but alas and alack! this honor too was carried off by the great Audubon nearly a century ago. W. N. HUTT.

Raleigh, N. C., December 21, 1907.

The Telephones of the World in 1907.

An estimate made on January 1, 1907, showed the following numbers and distributions of telephones in the world:

United States	5,068,800,	or 68.5 per cent
Canada	130,000,	or 1.7 per cent
Europe	2,000,000,	or 27.1 per cent
Other parts of the world	200,000,	or 2.7 per cent
Totals	7,398,800	100.0 per cent

These totals are of necessity approximate, for it is very difficult to get figures from distant parts of the world. In countries also where the telephone service is under government management the returns are apt to be particularly delayed in the giving out.

From available statistics, the Bell companies of the United States gained 119 per cent in the number of their subscribers from the year 1903 until 1907. Independent companies in the Middle West, their stronghold, gained approximately 110 per cent during the same period. Supposing that their expansion in other fields was at the same rate, the number of "independent" stations at the beginning of the present year should have been between 1,800,000 and 2,000,000.

In Europe, the number of telephone subscribers doubles once in every six or seven years, a considerably slower rate than that in this country. However, it shows that the telephone is increasing in popularity on the Continent with reasonable rapidity.

Germany, at the commencement of the present year, had 678,855 telephones in use, Great Britain 481,018. All told, however, there were in use in Europe, with a population of nearly 425,000,000, but 40 per cent as many telephones as in the United States, with a population in the neighborhood of 85,000,000.

In Sweden, ninety-seven works were in operation during 1906 for the production of forge iron and steel.

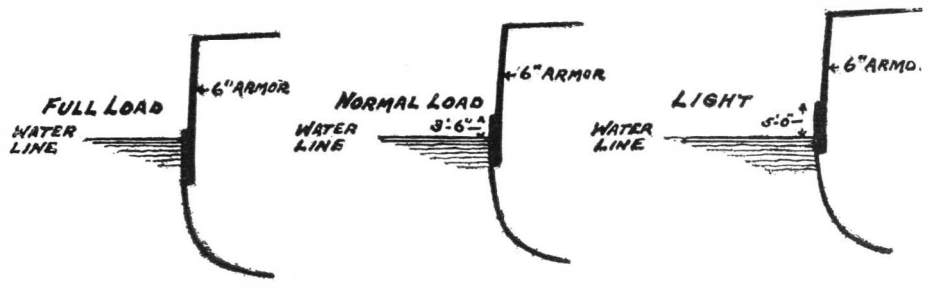
THE REUTERDAHL ATTACK ON OUR NAVY.

II. ARE OUR SHIPS INFERIOR TO THOSE OF THE LEADING FOREIGN NAVIES?

Replying in our last issue to the charge, that the supposed faults in the warships of the United States navy are due to the fact that the designing of these ships is confined to a particular board and certain bureaus, and that the sea-going officer has little to say about the matter, we proved conclusively that, so far from his being ignored, the sea-going officer has been in the majority on the various Boards which have determined the leading characteristics of our vessels. We showed that our ships, and particularly those built since the Spanish war, embody the ripe experience of the ablest men in the various branches of the naval service. Yet we are asked by Mr. Reuterdahl in McClure's to believe that "the ships of the battle fleet of the United States are in exactly the same condition as the Russian ships at Tsushima"; that the guns, mounted at low elevation, protrude from yawning gun ports, into which volumes of water will pour in a seaway, and through which shells will enter and burst, killing the gun crews, cutting the ammunition hoists to pieces, and blowing up the magazines; that the whole of the thick armor belt is generally below the waterline, and that shells would blow in the thinly-armored sides above the submerged belts; that our ships are without torpedoes and torpedo tubes, and without suitable guns to fight off the enemy's destroyers, and so forth and so on—the upshot of it all being that our navy is in no condition to go to war, and therefore, we suppose, must be considered as of practically no consequence at all.

In the present article we will take these charges *seriatim*, and show that, generally speaking, they are either gross exaggerations, or have no basis whatever of fact.

It has long been recognized among naval experts, that all criticisms and comparisons of ships, if they are to have any value, must be referred to some common standard, comparison being made only between ships of the same date and the same displacement, and all questions of draft, freeboard, height of guns, etc., being referred to some common waterline. The broad underlying fallacy which vitiates not merely Mr. Reuterdahl's article, but the whole of the campaign of criticism of the past few months, is that this essential principle has been largely ignored.

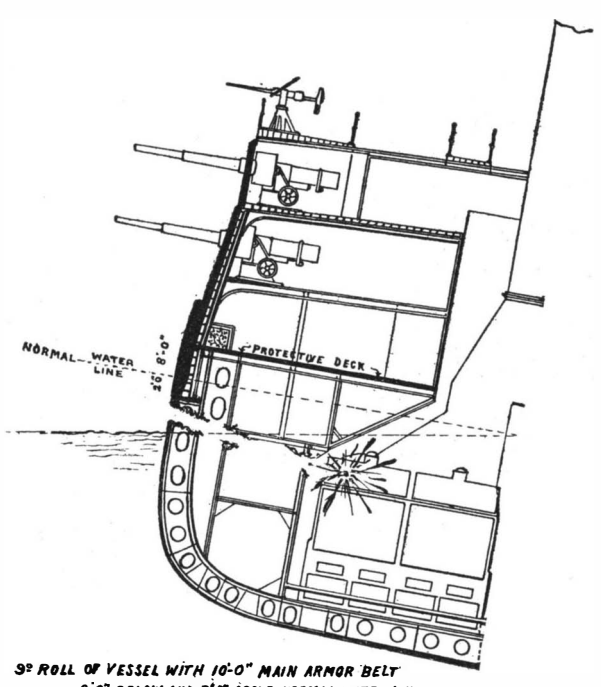


Diagrams Showing Variations in Freeboard and Waterline.

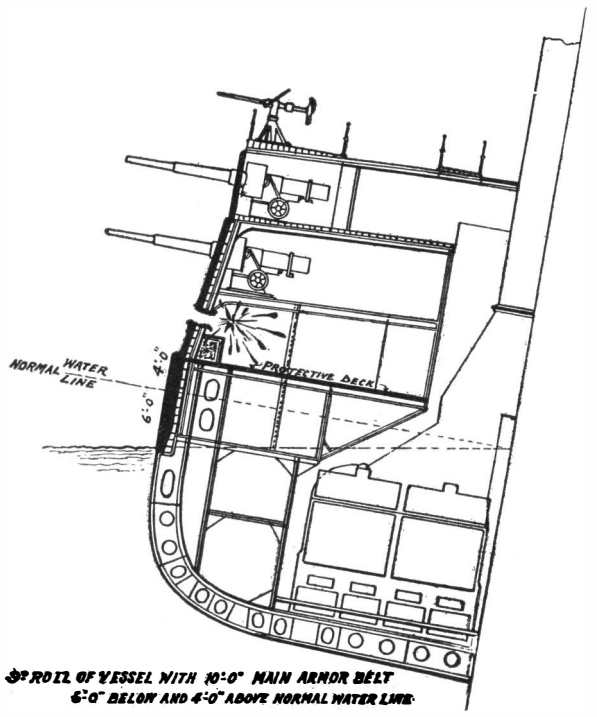
Mr. Reuterdahl says we have built our ships "with submerged armor" and with insufficient freeboard.

The freeboard (height of top deck above water) and the position of the armor belt will depend on the draft. Between full load on leaving for a cruise and light load on returning to the navy yard, there will be a difference of several feet in the height of a ship and its armor above water. For convenience in stating dimensions, all navies measure from the "mean" or "normal" draft. Mr. Reuterdahl's article is misleading because he apparently bases his figures for the United States navy on an excessive full load, and for foreign navies on the normal load.

1. Submerged Armor Belts.—Mr. Reuterdahl states that "of all our battleships, not one shows the main armor belt 6 inches above the water when fully equipped and ready for sea." As a matter of fact, our ships, if we include those now building, show from 18 inches to 11 feet 6 inches of thick armor above the waterline when fully equipped. Because the waterline of a ship must change with the amount of load she has on board, it is necessary to have some fixed datum to which her displacement, draft, freeboard, etc., may be referred. This datum, in our own and the British navy, is known as the mean or normal waterline. It is the level at which our ships float, when they have about two-thirds of their ammunition and stores and about 800 or 900 tons of coal aboard; and it is at this draft that the ship is required to make her specified speed during the government trials. Thus, in the case of the "Vermont," whose designed normal or mean draft is 24 feet 6 inches, the top of the armor belt at this draft is 4 feet 3 inches above the waterline, and in this condition she is carrying two-thirds of the full supply of ammunition and stores and displaces 16,000 tons. At the designed full-load displacement, she displaces 1,650 tons more. It takes 63.14 tons to sink the "Vermont" one inch deeper in the water, and hence the addition of 1,650 tons will add 26 inches to her draft. Hence, at full-load draft the top of the belt would be still 25 inches above the water. Similarly, the "Maine" increases her draft, from normal to full-load displacement, by 20 inches, leaving 22 inches of the main belt above the water at full load. In preparing for a cruise like that to the Pacific, however, a large amount of extra material is taken aboard, and the last pound of coal is crowded into the bunkers. One of the battleships now on the Pacific cruise, in addition to spare propeller blades, anchors, etc., carries an extra crankshaft for her engine. But even with this added load the ship in question showed her belt above the waterline.



9° ROLL OF VESSEL WITH 10'-0" MAIN ARMOR BELT 2'-0" BELOW AND 8'-0" ABOVE NORMAL WATER LINE

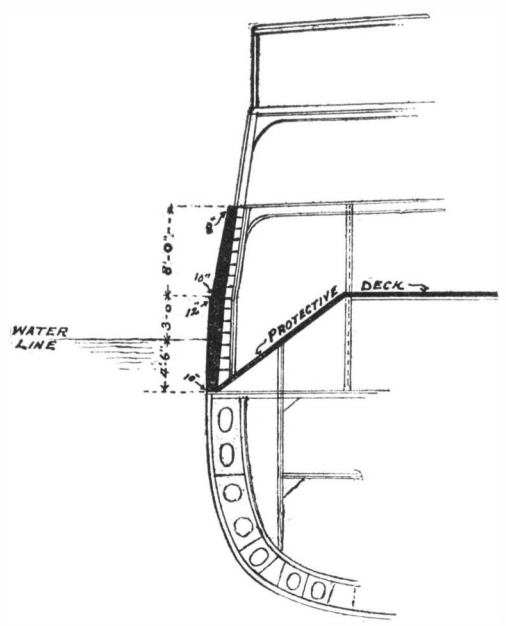


9° ROLL OF VESSEL WITH 10'-0" MAIN ARMOR BELT 6'-0" BELOW AND 4'-0" ABOVE NORMAL WATER LINE

The Peril of Raising the Belt.

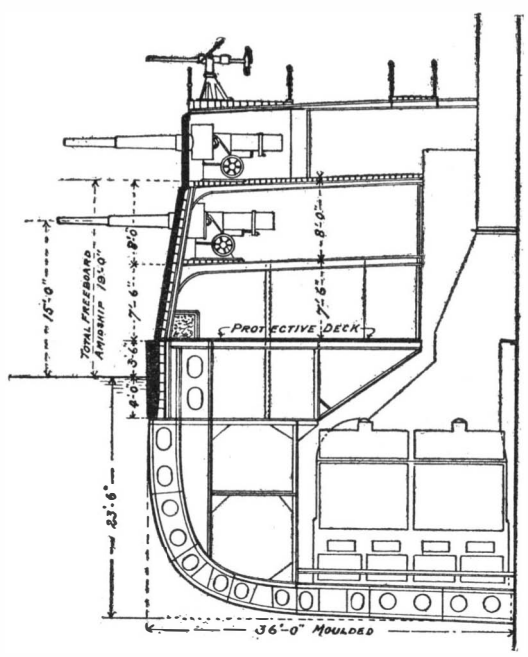
Mr. Reuterdahl says: "Meanwhile the United States makes no movement to raise its waterline armor to where it should be."

The United States makes no movement to raise its waterline armor, because to do so would be to invite disaster. A low belt would not expose the unarmored bottom under conditions of rolling in which a high belt would expose four feet of it. A shell entering above the belt would burst in the small compartments of the berth deck, where the inflow of water would be limited. A shell entering below the belt would flood the big boiler or engine rooms or explode the magazines.



The Wide and Heavy Belt of U. S. S. "South Carolina" and "Michigan."

Mr. Reuterdahl says: "The United States has five big battleships now building, *not one of them*, in spite of the continual protest of our sea-going officers, *with its main belt above the waterline*." (*Italics* are ours.) The facts are: The lower belt of the "South Carolina" is 3 feet 0 inches above the water. Above this is another belt 10 inches to 8 inches thick, thus affording a belt amidships of an average thickness of 10 inches and 15½ feet wide. Two others, "Delaware" and "South Dakota," have similar protection. The fifth ship, "New Hampshire," has a 9-inch belt, 4 feet 3 inches above water. Above this is 7-inch armor, 16 feet wide, which is as thick or thicker than *main* belt of the 12 British battleships of the "Canopus" and "Duncan" classes. (See diagram on adjoining page.)



Midship Section of the "Maine."

Mr. Reuterdahl speaks of "the lowness" (low freeboard) of American ships, the "bows" of some of the latest of which "are only about eighteen feet above the waterline"; the "forward decks" of others "sixteen feet high."

The above section of the "Maine" is representative of ships built since the Spanish war. It shows the normal freeboard to be 19 feet amidships; forward it is 19½ feet. Mr. Reuterdahl says: "The constructor's plans were made to have from 12 to 30 inches of the armor belt out of water when each vessel makes her trial trip." A preposterous statement, as the engraving above and the following figures show. The designed height of top of belt on trial trip (normal draft) was as follows; "Kearsarge," 3 feet 6 inches; "Alabama," 3 feet 7 inches; "Maine," 3 feet 6 inches; "Virginia," 3 feet 0 inches; "Connecticut," 4 feet 3 inches; "Idaho," 4 feet 3 inches; "South Carolina," 3 feet 0 inches.

2. Low Freeboard.—Mr. Reuterdahl has much to say about the "lowness" of American ships, and he would have us believe that the forward decks are much lower than those of foreign ships. He says: "*All*" (the *italics* are ours) "modern battleships in

There has been altogether too much wild talk about submerged armor belts, and its absurdity is evident when it is brought to the cold test of facts and figures. A naval officer recently assured the writer that the "Virginia" not long ago started from a navy yard with the top of her belt 2 feet below the water. Now, in dissecting this statement, we find that at normal load, when the "Virginia" displaces 15,000 tons, this mark is 3 feet above the water; so that according to our informant she must have sunk 5 feet or 60 inches below her normal draft. It takes 60.95 tons to sink the "Virginia" one inch below her normal draft. Therefore, to get her belt 2 feet below the water she must have taken on board 3,657 tons dead weight, and her displacement must have been 18,657 tons, 700 tons greater than that of the huge British battleship "Dreadnought." This is a fair sample of much of the absurd talk that has been indulged in during the past three months on this question of submerged armor belts.

Furthermore, even if the belts were submerged, which they are not, when our ships start out to find and fight the enemy, the consumption of coal, provisions, water, etc., would bring them up several inches a day, and, by the time they met the enemy, it is probable that they would be floating not much below their normal draft, with several feet of the belt above water.

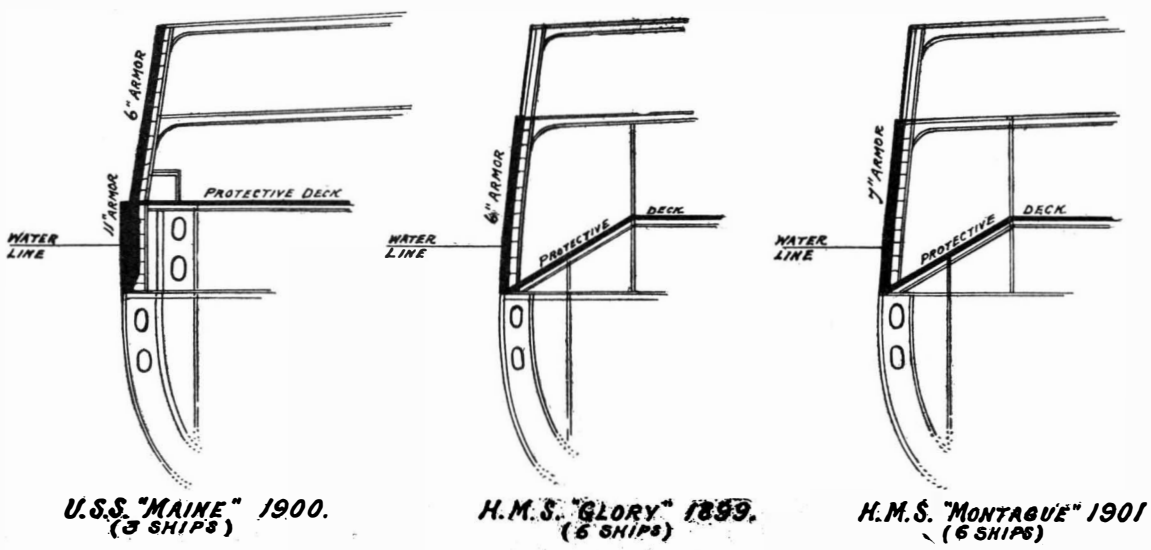
foreign navies have forward decks about 22 to 28 feet above water." We have no space to consider the various foreign navies in detail, and in this reply we will confine ourselves to the acknowledged leader of them all, the British navy. What are the facts? With one single exception, the "Dreadnought," there is not a British battleship in commission with a forward deck 28 feet above the water, all the other modern battleships being, like our own, three-decked ships, that is, having a berth deck, gun deck, and main or upper deck above the protective deck; and the height between decks being about the same for all ships, viz., from 7 feet 6 inches to 8 feet, it follows that the height above normal waterline is approximately the same. As a matter of fact, on several of our ships the height between decks is greater than on the British ships, and the freeboard is correspondingly greater. The two photographs herewith shown of the "King Edward" and the "Vermont," selected because the ships are of about the same date of design, show the "Vermont" to have actually a foot more freeboard on the same normal flotation line. The "draft marks" (figures painted on the side) on the "King Edward" clearly indicate the position of the normal waterline for her known normal draft of 26 feet 9 inches.

3. "BROADSIDE GUNS USELESS IN A SEAWAY."—The question of freeboard is intimately associated with that of the height of guns above water. Though we have not at hand the figures of freeboard of the British ships, the low elevation of broadside batteries on certain crack British ships as compared with our own, proves conclusively that their freeboard must generally be considerably lower, and not, as Mr. Reuterdahl states, considerably higher, than that of our ships of the same date. Therefore, all his pictorial description of the trouble our turrets and broadsides would encounter when steaming in a seaway, may be relegated to that land of fiction to which so much of this article belongs.

Not only would "one-third of our guns" not be "useless in a seaway," but the muzzles of the guns would be clear of the water when the eight battleships of the "King Edward" class and the two battleships, "Swiftsure" and "Triumph," to say nothing of the four armored cruisers of the "Drake" class, would be rolling theirs under.

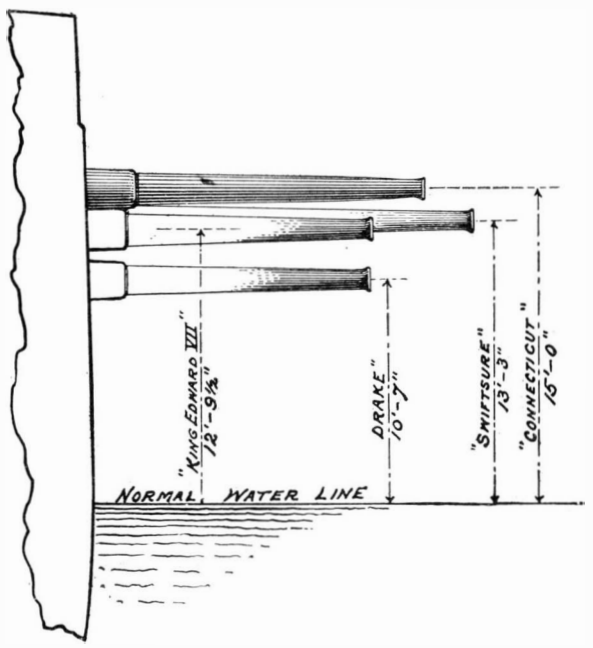
We have always been a great admirer of Mr. Reuterdahl's marine pictures; and one of the chief elements of their charm, for the writer at least, is their freedom of treatment. The trouble with the present article is that the artist has carried this freedom of treatment into a field from which it should have been most rigidly excluded. The statement that "broadside guns of foreign battleships and cruisers are, generally speaking, twice as high as ours, and many of them three times as high," would be startling indeed if it were true. As a matter of fact, our broadside guns are as high as the similar broadside guns in the German and Japanese navies, and, as we have seen, are from 2 to 4½ feet higher than those in some of the finest modern battleships and cruisers of the British navy.

The question of giving ships a lofty freeboard is not as simple as Mr. Reuterdahl seems to think. To add a forecastle deck, raising the freeboard from 20 to 28 feet, means the addition of an enormous weight, and, on a given displacement, involves heavy sacrifices, either in guns, armor, speed, or coal supply. Grave questions of stability are also encountered. We hear much in this controversy about the high freeboard of the French ships. As a matter of fact, there are two schools of design: the French, favoring lofty freeboard, and the British, American, Japanese, and to a less extent the German, favoring a 20-foot freeboard. The British, of whom Mr. Reuterdahl mistakenly gives the impression that they have several 28-foot freeboard ships, were content with 20 feet until the great length of the "Dreadnought" compelled the addition of a forecastle deck to give her good sea-riding qualities. All this talk about flooded turrets and broadside guns useless in a seaway is no more, and not as much, applicable to our own navy as it is to the others of the same school. The battle of Tshushima was fought by Japanese ships of the same freeboard as our own, and in weather that was described in Admiral Togo's report as "rough." But we have yet to hear that the Japanese broadside guns were "useless in a seaway"; and our broadside guns are as high, if not higher, than theirs.



This Shows Superior Side Armor Protection of United States Ships.

Mr. Reuterdahl says of the ships of the United States navy: "When fully loaded for sea, practically the whole of the ship's waterline belt is under water. Above this is a thinner armor, which can be pierced by heavy shells." On the same page he says: "The British . . . . have always raised the armor they considered vital many feet above the water." Testing this statement by a comparison of the United States "Maine" with the British "Glory" and "Montague," we find that whereas the American ship has side armor from 11 inches to 6 inches thick, and 23 feet wide, the 12 British ships of the same period have only 6-inch and 7-inch armor, 14 feet wide. Moreover the "Maine's" Krupp armor has 25 per cent more resisting power for equal thickness than the "Glory's" Harvey armor. Hence compared with the "Glory," the "Maine" has side armor 13⅛ to 7⅛ inches against 6 inches thick, and it is 9 feet wider.

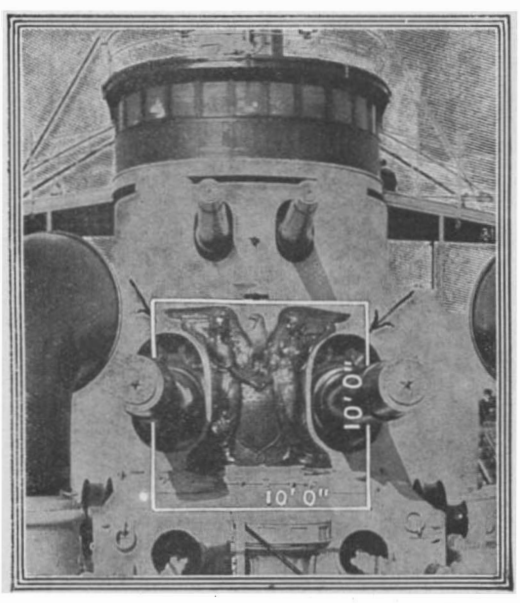


Height of United States and Foreign Guns Above Water.

Mr. Reuterdahl says: "The broadside guns of foreign battleships and cruisers are, generally speaking, twice as high as ours, and many of them are three times as high." How grossly this is in error is shown by the above diagram, based on an article and drawing in London Engineering of January 15, 1904, discussing the height of British guns. We have added the 7-inch guns of the "Connecticut." So far from the foreign broadside guns being "twice" or "thrice" as high as ours, the facts are that on these fourteen crack British ships they are several feet lower.

4. POOR PROTECTION FOR GUN CREWS.—Mr. Reuterdahl's imagination never leads him so far away from the facts, as when he comes to speak of the poor protection for gun crews due to over-large gun ports and the poor subdivision of the broadside batteries. The story of the "enormous" turret ports of the "Kearsarge" and "Kentucky," and the pathetic incident of the "painted wooden canvas screens" has been retailed to the public *ad nauseam*. As a matter of fact, these turret ports are large, only in comparison with the naturally smaller ports which appear in turrets using an inclined face of the character shown on our front-page engraving. The "Kentucky" and "Kearsarge" are pretty old ships, as things go nowadays; for their designs were prepared some thirteen years ago. The turret ports were no larger than the necessities of the type of gun mount used at that period demanded. The fronts of the turrets of the "Alabama" class, which followed the "Kearsarge," are inclined, and the ports are proportionately smaller. It is an abuse of the ethics of fair criticism to keep ringing the changes on the supposed poor design of this out-of-date ship, without making any reference to the fact that in all of our later ships the ports have closed in on the guns until the protection is ample. Mr. Reuterdahl is so fascinated with these "yawning gun ports" that apparently he sees double, if not quadruple; for he tells us that "the openings above and below the guns in the turrets of these ships are 10 feet square"! Were this indeed the case, there would be not one square foot of the port plate left, and the Empire State Express could drive bodily into the turret without let or hindrance. Well might "the service journal, the Navy," say that "these ships are not fit for service in battle line against a really modern vessel." In his search for further proof of poor protection for our gun crews, Mr. Reuterdahl goes back to ships that were authorized from twelve to seventeen years ago, and speaks of the broadside guns which "stand glowering from unprotected or badly protected openings as wide as double doors"; but he omits to state that most foreign ships of the same date used the same wide ports, and that many of them, notably in the British navy, mounted their guns in the open with nothing but shield protection. So also he states, by implication, that there is no attempt at isolation of the separate broadside guns from shell fire on eleven of our battleships, upon which, as a matter of fact, special screen protection has been carefully provided.

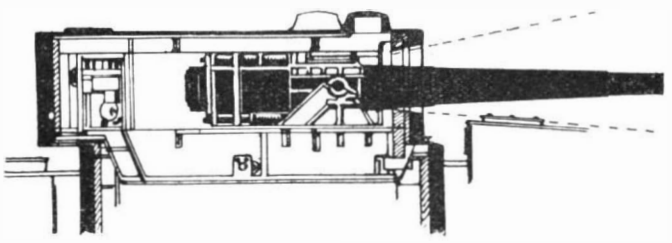
5. THE OPEN SHAFT TO THE MAGAZINE.—That Mr. Reuterdahl's criticisms of the open shaft, or well, leading down from the turret guns to the handling room below is well made, is proved by the fact that what is known as the interrupted hoist, with a floor cutting off the upper from the lower part of this shaft, is being installed on our latest ships. It is only fair, however, to bear in mind the considerations which led to the adoption of the present type of hoist. In the first place, at the period when it was designed, our ord-



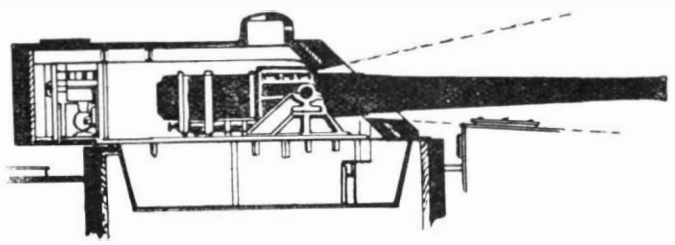
Courtesy of McClure's Magazine.

The Forward Turret Ports of the "Kearsarge."

Mr. Reuterdahl says: "The openings above and below the guns in the turrets of these ships are ten feet square." We have drawn to scale in white lines upon the engraving an area "ten feet square." Further comment is unnecessary.



Section Through 13-inch Turret of "Kearsarge," Showing Vertical Front Wall and Large Ports.

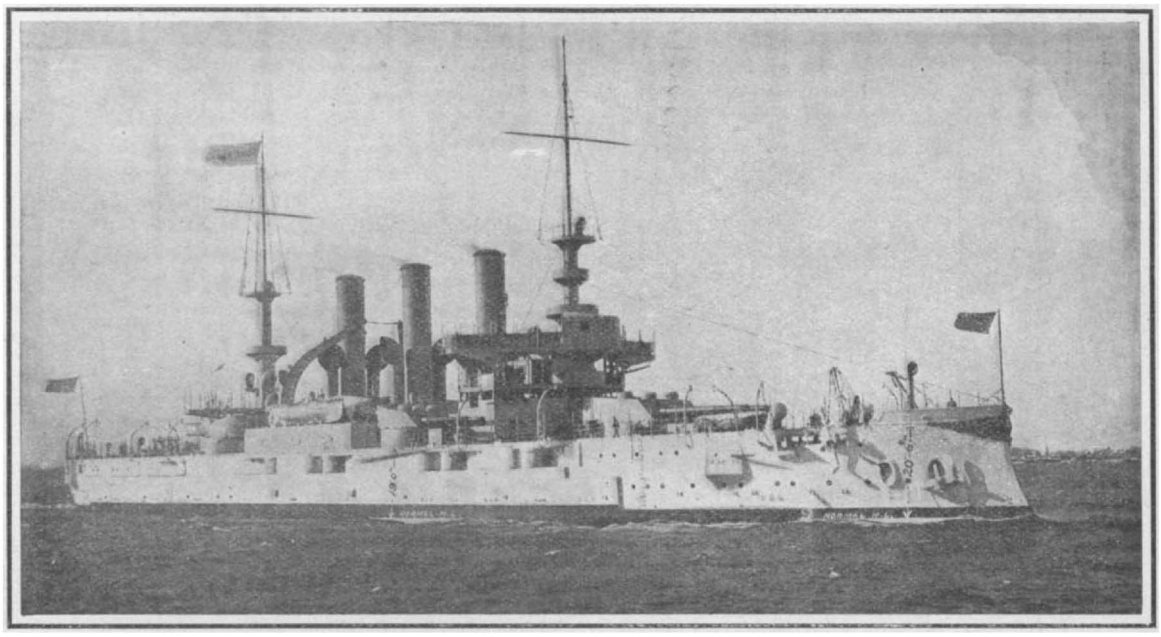


Section Through 12-inch Turret of "Maine," Showing Inclined Front Wall and Small Ports.

The earlier turrets of all navies had vertical front walls, necessitating deep openings to allow the guns to be elevated and depressed. When inclined front walls came to be used, the armor was brought close to the trunnions of the gun, enabling the opening to be greatly reduced. See front page engraving. The large ports are not an error. They are a mechanical necessity of the vertical wall turret.

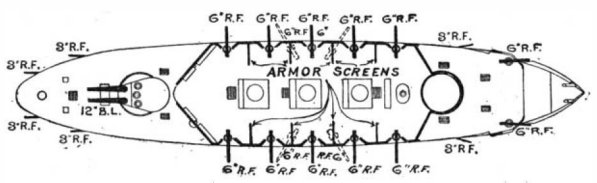
nance officers were anxious to avoid a very serious defect which existed in many foreign ships, and noticeably the British, namely, that the loading could be done only in one position. That is to say, if a ship were firing on the broadside, her turret guns would have to be swung back to the axial position for loading to bring the breech in line with the loading tray and rammer; an arrangement which entailed a great loss of time and a slow rate of fire. Our officers designed a hoist which rotated with the gun and its carriage, and brought the ammunition direct from the handling room to the breech, no matter on what point of bearing the gun was laid. This, of course, necessitated an opening direct down to the handling room. In its later form, the hoist was given a high speed of 600 or 700 feet a minute, and it is believed to give a more rapid service and enable a faster rate of fire to be obtained, than is possible with the big guns of other navies. The hoist gave great satisfaction, and no complaints were heard until the introduction of smokeless powder developed the danger of "flarebacks." To meet this difficulty, the Ordnance Bureau provided gas-ejectors for blowing the combustible gases out of the guns before the breech was opened, and stringent regulations were laid down to prevent crowding of ammunition up to the gun in the effort to obtain rapidity of fire at target practice. Later, an intersecting floor of steel was placed at the mid-height of the turret shaft, with an automatic shutter, which lifted as the charge passed through and then fell by its own gravity, shutting off the handling room from the turret. With a view to shutting off the ammunition room from the handling room floor below the turret, the doors to the ammunition room are provided with circular hinged shutters, and the instructions are that these shutters shall be closed except when a charge is passed through them. Now, it is well known in the navy that, in the zeal to secure good target records, these safety devices have, at times, been rendered inoperative; and it is a fact that much of the loss of life in the target practice accidents of recent years would have been avoided, had the safety devices been fully utilized, and the instructions for safeguarding the powder been strictly followed. There is one feature in which the hoisting gear of our turrets is subjected to unjust comparison with that of foreign battleships. The impression may be gathered from Mr. Reuterdahl's description that every foreign battleship has an independent ammunition hoist, with track, ammunition cars, and cable complete in itself. This is not the case. There is but a single cable, and the auxiliary gear consists of a hand-operated crankshaft geared to the motor shaft which drives the one cable. Should the motor be short-circuited or otherwise injured, the driving shaft can be hand-operated, but, of course, at only a slow speed. If a shell fragment should cut this cable on a foreign ship, the whole hoist would be immediately put out of business, and the turret would be just as completely disabled as our own.

6. Lack of Torpedoes and Destroyers.—We are entirely in agreement with Mr. Reuterdahl in his belief that our weakness in torpedo-boat destroyers is a distinct menace to the efficiency of the navy. Congress should make liberal appropriations for ships of this type, which should be of not less than 750 tons displacement, and 30 to 32 knots speed. Such boats should be of sufficient strength and freeboard to enable them to cruise with the fleet in any weather. But Mr. Reuterdahl is in error when he considers that the lack of submerged torpedoes in the ships of the Pacific fleet is a serious matter. Expert opinion on this question has been "seesawing" for several years, according as the speed and range of the torpedo, or the range and dealiness of armor-piercing gun fire, have been in the ascendency. In 1903 the General Board, speaking on this question, said: "The range, speed, and accuracy of torpedoes have so greatly increased within the last year or two, that at the present time the torpedo may be considered a weapon of offense to be seriously reckoned with up to 3,000 yards, and even more. Since gun fire, in order to result in a decisive action, must be delivered at a range not greatly exceeding 3,000 yards, it follows that the tactics of fleet actions will hereafter be influenced by the presence or absence of torpedoes." Since that opinion was given, the battle range has increased from 3,000 to 8,000 or even 10,000 yards, as witness the remarkable shooting up to 9,000 yards made by our own "Connecticut" during the past summer. At such ranges the torpedo becomes an incumbrance, and the space occupied by the submerged torpedo room may much better be given up to coal or stowage.



Battleship "Vermont." Displacement 16,000 tons. Designed 1902-3.

The "Vermont" is here shown steaming out for her trial trip at the normal contract draft of 24 feet 6 inches. Her broadside guns are not aboard, but she has taken aboard sufficient water ballast to bring her to the normal waterline. In this condition she shows 19 feet of freeboard amidships and 20 feet 6 inches forward. The ports of the broadside guns are 15 feet above water, and the top of her belt is 4 feet 3 inches above water. At the official "full load displacement," when the ship is equipped ready for sea, the top of belt will be still 2 feet 1 inch above water. Yet Mr. Reuterdahl says: "Of all our battleships, not one shows its main armor-belt six inches above the water, when fully equipped and ready for sea."



Deck Plan of "Maine," Showing Armor Screens.

Mr. Reuterdahl says: "In none of our ships afloat, except only the five of latest design, is this principle" (isolation of individual guns against bursting shells) "observed." This is a gross error. The facts are that all the ships of the "Alabama," "Maine" and "Virginia" classes, eleven in all, do have such protection in the shape of armor screens between the guns, as shown in above plan.

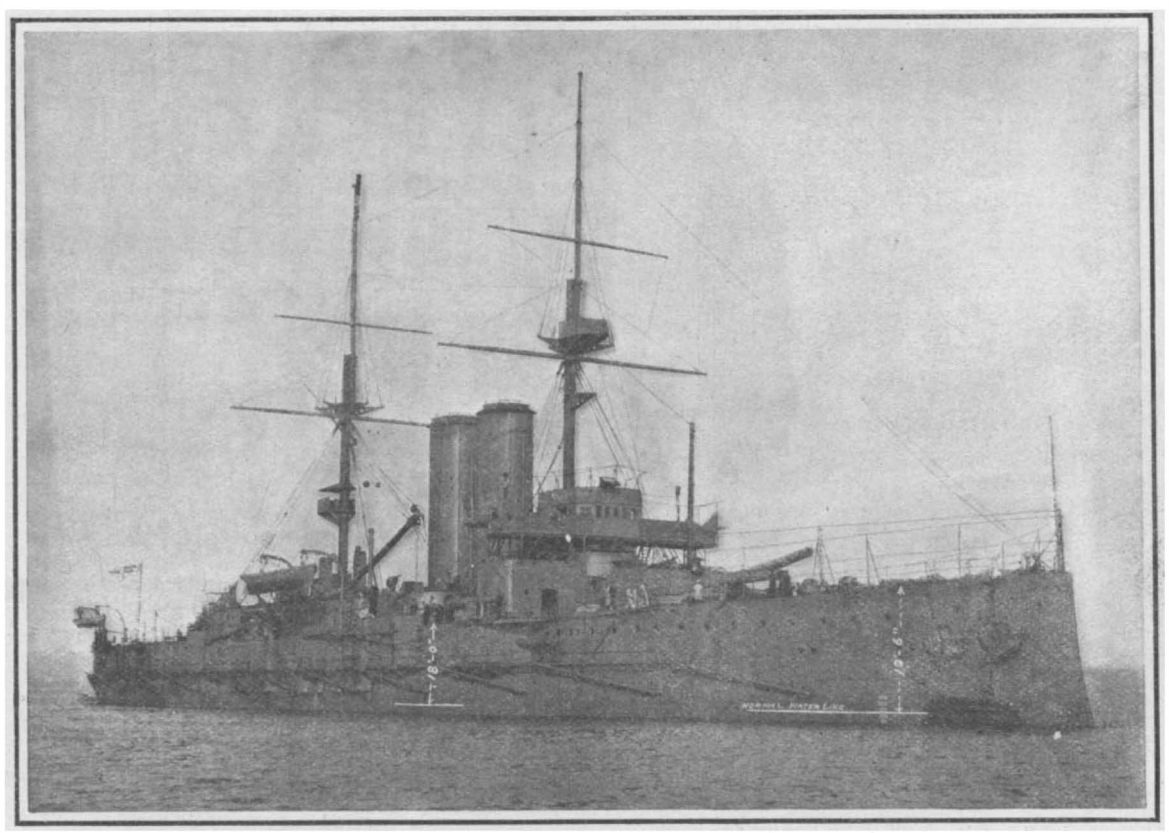
In concluding this answer to the criticisms of Mr. Reuterdahl's article and to the general campaign of criticism by which it was preceded, we wish to state that the Scientific American has based its statements upon facts which are either of its own knowledge or gathered from public government documents. We believe that after a careful consideration of the *facts* as here presented, the general American public will agree with us that our navy stands second to none in the general efficiency of its ships.

There is one feature, however, in which our ships are superior, and often greatly superior, ton for ton, to the ships of other navies. We refer to the exceptionally heavy armament which they carry. Since the days of the Revolutionary war, it has been our aim to mount upon our ships heavier batteries than were carried by foreign ships of corresponding size; and to this policy very largely have been due our most brilliant victories, particularly where single ships were engaged. That policy has been steadily followed in the creation of our new navy, whose birth may be dated from the year 1883. Although Congress has persisted in the most unreasonable practice of stating what the displacement of the ships shall be, the Department has succeeded in equaling the foreign ships in speed, protection, and coal supply, and at the same time has greatly outmatched them in the weight of the armament.

A Timber Famine Predicted in Twenty Years.

Gifford Pinchot, the government forester, made the declaration, on the return from a six months' inspection trip, that "in twenty years the timber supply in the United States on government reserves and private holdings, at the present rate of cutting, will be exhausted, although it is possible that the growth of that period might extend the arrival of the famine another five years." Mr. Pinchot urges that the magnitude of the danger should not be underestimated, for every man, woman and child in the country would be affected by such a famine. Although about one-fifth of the forest area of the country is made up of government reserves, attention is called to the fact that the government does not control a corresponding fraction of the timber supply, because the government lands are not so good as those owned by private owners. Money is to be asked for to extend the forestry service, and to push the work of reforesting the denuded timber lands, although it is claimed to be utterly beyond the powers of the service to meet the situation and prevent serious trouble. An effort will be made to protect the Appalachian forest and promote the growth there.

The State forester of California has advocated a plan that is being watched with much interest. In that State, under the police power, the forester is attempting to protect the watersheds and to prevent private owners from devastating these lands in a manner that will injure the irrigation of lands lying below. Figures have been produced to show that at the present increase in the value of timber land, the owners of such property are making more by letting the timber develop than they would by cutting and placing the money out at interest.



Battleship "King Edward." Displacement, 16,350 Tons. Designed 1901-2.

The "King Edward," one of a class of eight of the latest British battleships, is here seen floating light at a draft of 25 feet, as shown by "draft marks" abaft of mooring buoy. We have marked the normal draft of 26 feet 9 inches by white lines. Her normal freeboard is 18 feet amidships and 19 feet 6 inches forward, or one foot less than that of the "Vermont." Yet Mr. Reuterdahl says: "All modern battleships in foreign navies have forward decks from about 22 feet to 28 feet above the water"!

THE REUTERDAHL ATTACK ON OUR NAVY ANSWERED.

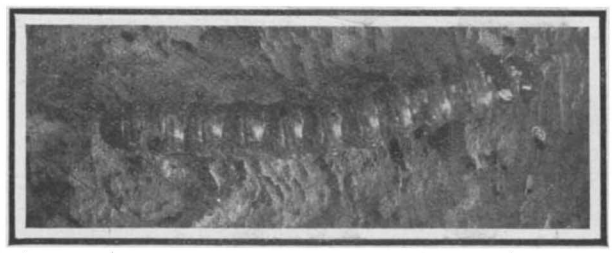
INSECTS THAT ARE EATEN.

BY PERCY COLLINS.

Probably few people are aware that insects, as a group, constitute a source of food supply for the races of mankind. Yet insects have been eaten from time immemorial, sometimes figuring as luxuries, at others as a staple article of diet. Perhaps the chief food insect—and a very important one, too—is the locust. It furnishes the favorite food of many numerous African tribes, some nations living almost exclusively upon its teeming hordes. Locusts have been regarded as luxuries from the earliest times of which any records remain to us. In the British Museum there is a Nineveh sculpture showing men carrying different kinds of meat to some festival, and among them are some who carry long sticks to which locusts are tied. In Athens of old, locusts and grasshoppers were sold in the markets, and they were then preferred as dainties above the most succulent quails or the best figs. In the law of Moses, as set forth in the book of Leviticus, we find locusts permitted as food to the Jews; and to the present day, in Palestine, these insects are fried in sesame oil and eaten. In Arabia Petrea locusts are dried in the sun and ground into a kind of flour for cake-making. In Central Africa certain tribes make them into thick brown soup. In Madagascar they are baked in huge jars, then fried in grease and mixed with rice. In Algeria they are simply boiled in water and salted to taste. The Arabs grind and bake them as cakes, roast them in butter, or crush them with camel's cheese and dates; but it is said that they only resort to this fare in years of famine. In southern Russia, where locusts are still extensively eaten by the serfs, the insects are usually smoked in the first instance like fish. When required for consumption, the legs and wings are broken off, and the bodies are then boiled, roasted, stewed, fried, or broiled.

According to Mr. P. L. Simmonds, who made an exhaustive study of strange kinds of animal food, the flavor of locusts, while strong and disagreeable when raw, becomes mild and readily disguised when cooked. In fact, from his own experience, and that of several of his friends whom he induced to partake of the fare, he assures us that a broth made by boiling the unfledged *Calopteri* (a Rocky Mountain species) for two hours in the proper quantity of water, and seasoned only with pepper and salt, is quite palatable, and scarcely to be distinguished from beef broth. From the same authority we learn that locusts, fried in their own oil, and with the addition of a little salt, have quite a nutty flavor, and are by no means unpleasant eating. Indeed, the flavor very quickly becomes an "acquired taste," and the experienced locust eater grows very fond of it. That a judicious course of locust fare is wholesome and nourishing cannot be doubted, for locust-eating tribes invariably grow fat when the food is plentiful. Moreover, it has been suggested that these insects, nicely cooked and served, would prove beneficial in cases of wasting disease.

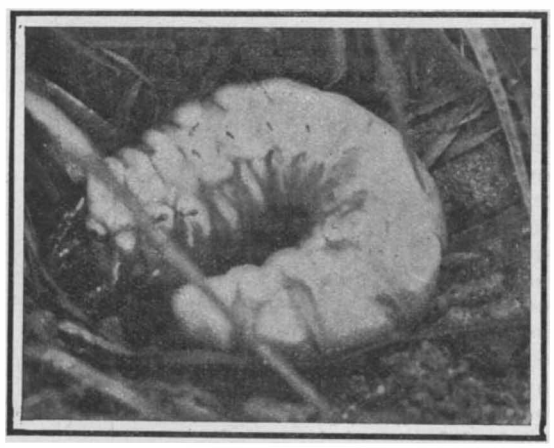
Apart from locusts, the most popular insect food consists of grubs and caterpillars, of which many species are eaten with avidity in different countries of the world. Few people realize that the grub of the common cockchafer (*Melolontha*), when properly dressed, forms a nutritious and actually dainty food. Yet such is unquestionably the case. Twenty years or so ago, a banquet was given at the Café Custoza in Paris for the special purpose of demonstrating the excellent qualities of the *ver blanc*, as this grub is called. The insects were fried to a golden brown color in a paste of flour, milk, and eggs; and of the fifty guests present, the majority called for a second helping. A receipt for cooking these grubs, which is still extensively employed in certain parts of France, is as follows: "Roll the *vers blancs*, which



9. The Larva of the Goat Moth, the Cossus of the Present Day.

are short and fat, in flour and bread crumbs, with a little salt and pepper, and wrap them in a stout piece of paper, well buttered inside. Place it in the hot embers, and leave it to cook for twenty minutes, more or less, according to the degree of heat. On opening the envelope a very appetizing odor exhales, which disposes one favorably to taste the delicacy, which will be more appetizing than snails, and will be declared one of the finest delicacies ever tasted."

That the ancient Romans were very partial to a large wood-boring grub as a dainty is certain, but



10. The "Ver Blanc" Occasionally Eaten as a Delicacy in France.

exactly what insect this was has never yet been satisfactorily ascertained. The Romans called it "Cossus"; but the *Cossus* of our day is the grub of the large goat moth, at times so destructive to fruit trees. This insect possesses a very objectionable odor, which seems to indicate an equally unpleasant taste, so that it seems unlikely that epicures of the past can have found in it any attractions. Some naturalists are inclined to regard the grub of the Stag beetle as the original "Cossus," and certainly its larva is sufficiently large to make a juicy mouthful, while there is no reason to suppose that it would prove less appetizing than the *ver blanc*. On the whole, however, the larva of the large wood-boring beetle known as *Prionus* seems most likely to have been the Roman dainty. It is found all over Europe in half-decayed oak trees, grows to a great size, and unquestionably possesses culinary possibilities.

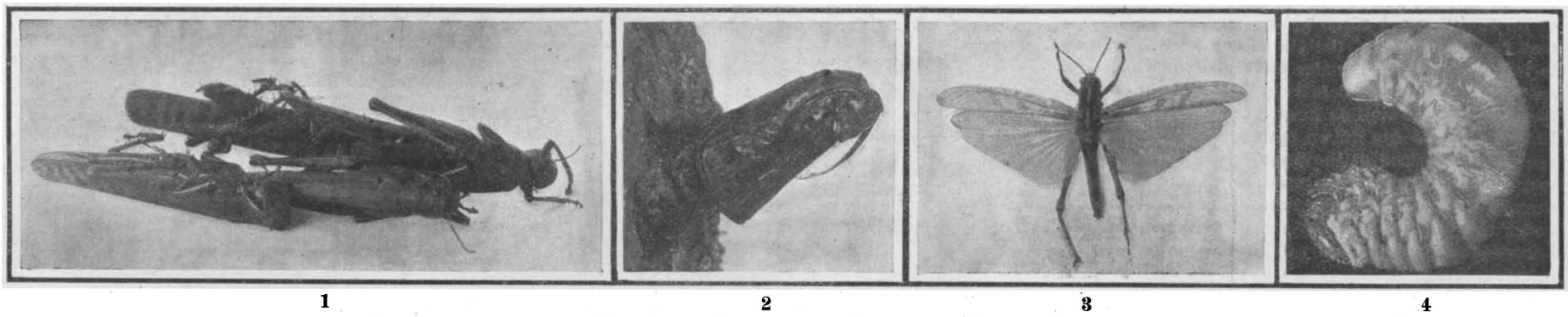
So far as the writer is aware, the only butterfly distinguished by supplying food to mankind is an Australian species called by the natives "Bugong." Regularly every year this insect congregates in vast swarms on the rock slopes of the Bugong Mountains, and it is said that the natives light great fires beneath the trees upon which the butterflies have settled for the night, thus suffocating them and bringing them to earth. When a sufficient quantity has been collected, the fire is cleared away, and the insects are spread upon the heated ground and raked about until their legs, wings, and feelers are singed off. The bodies are then pounded into a pulp in a wooden vessel, and afterward made into cakes.

Among the insects that are eaten it is necessary to include the famous grugru, or palm grub, of the West Indies, with the allied species found in Java. These grubs, when roasted on tiny spits and richly spiced, are said to surpass all other kinds of animal food in flavor. This, however, appears to be an acquired taste, for the traveler Leblond, who ate them in the Isle of Réunion, says that at first he thought them disgusting, but that after a little time he grew accustomed to them, and found them excellent.

Many other insects have been, and are, used as dainties. The ancient Greeks were very fond of cicadas or harvest flies—insects of a very wide geographical range, whose shrill note is a familiar country sound throughout the Southern States during the summer season. Cicadas are also eaten to-day by certain African tribes. The Greeks also were eaters of crickets; nor are these insects neglected at the present day, for the natives of a large portion of southeastern Africa dig up a large subterranean species, and roast it over a bright fire for food.

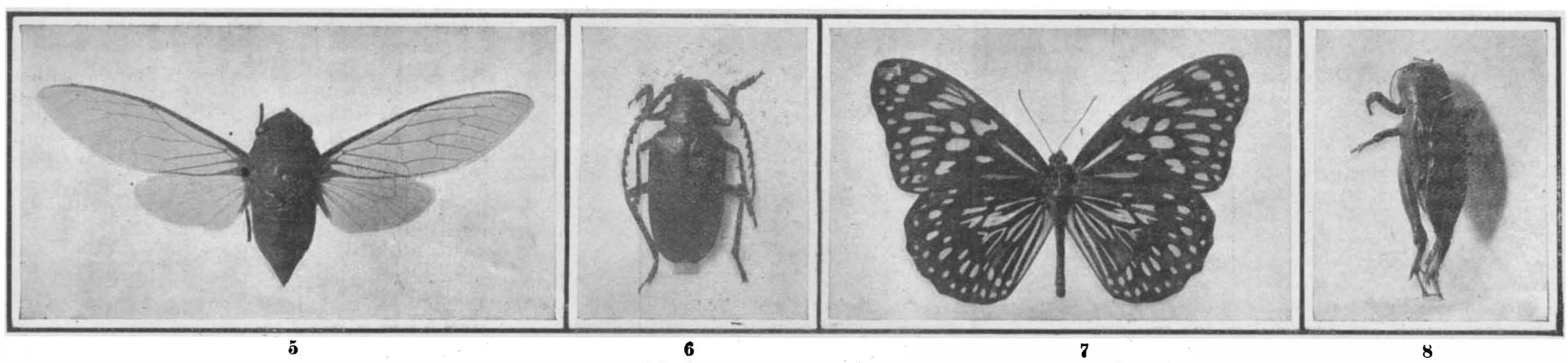
In China, where almost every kind of animal food, whether predisposing in aspect or the reverse, finds a ready market, the chrysalids of silkworms are regarded as a luxury by the lower classes. They are sold in the streets—after the valuable cocoons of yellow silk have been removed from them—and find willing buyers at a price equal to about ten cents per pound. As to their edible qualities, nothing can be said, for no civilized being has proved bold enough to taste the dish. The mere fact that the chrysalids are relished by the Chinese goes for nothing, it being impossible to place any confidence in the national palate of a race which actually raises the grubs of bluebottle flies in heaps of putrid fish near the seacoast, and values the produce more highly than the facility of obtaining it would lead us to believe.

It is related by M. Daguin that French peasant children are in the habit of catching wild bees for the purpose of squeezing from them the minute store of honey which each has collected. This reminds one of the use made of the Mexican honey ant. Those who have paid any attention to the natural history of this remarkable insect will be aware that certain individ-



1 2 3 4

1. Locusts as Offered for Sale in Moorish Markets. 2. Pupa of the Goat Moth (Cossus) After the Moth Has Emerged. 3. The Locust. 4. Larva of the Stag Beetle, Perhaps the "Cossus" of the Romans.



5 6 7 8

5. One of the Cicadas. 6. The Wood-boring Beetle Prionus; Its Larva Was Most Probably the Roman Cossus. 7. The Australian Bugong. 8. A Large Edible Cricket from Central Africa.

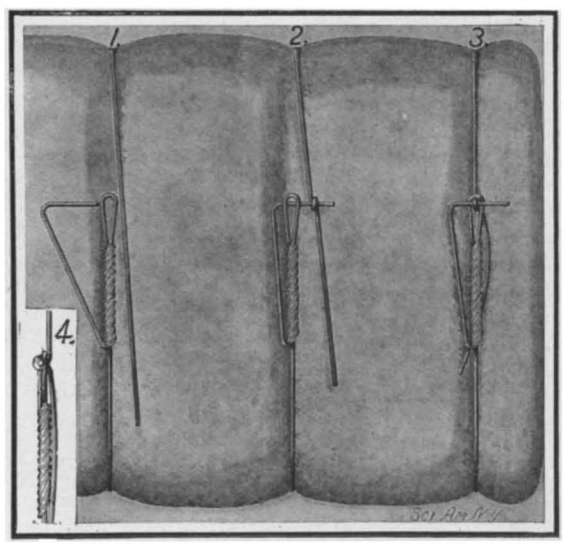
INSECTS THAT ARE EATEN.

uals in its colonies have the power of drinking in an enormous quantity of sweet nectar, until they become converted into veritable honey pots. They are used, in fact, as honey pots, to which the other ants bring their surplus store of sweets, and from which they draw a supply when they are pressed by hunger. Now these ants, distended with sweet juices, are sold by measure in the Mexican markets.

In conclusion, it may be said that all civilized races are insect eaters unconsciously. There is a small beetle, known as the corn weevil, which infests grain to an enormous extent. It has been known to damage hopelessly a cargo of wheat worth $80,000 during the voyage across the Atlantic; while even the cleanest and best wheat, after it has been stored for a period, is almost certain to harbor at least a few of these pests. And when this wheat is converted into flour, the beetles are ground up with it, and thus become a part of our bread, cakes, and confections.

AN IMPROVED BALE TIE.

When raw cotton is gathered and baled at the gin house, the degree of compression applied is ordinarily not sufficient to properly reduce the bulk of the bale for transmission to a distant market, and a second compression is given to such bales for their further condensation. The ties first placed upon the bale are then preferably continued in service, if they are uninjured. It is quite important to continue the service of the bale tie, as it saves time and the expense of a renewal of the ties when the bales are re-pressed, and to this end Mr. Edward H. Vance, of Colton, Texas, has invented the tie which is illustrated in the accompanying engraving. The tie consists of a wire, which is

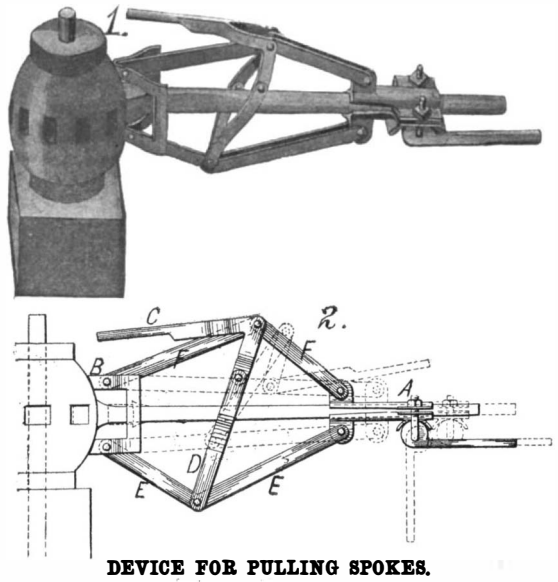


AN IMPROVED BALE TIE.

bent back upon itself at one end and twisted to form a loop. The end of the wire is then bent upward and at right angles to the loop, to serve as a hook or catch. The opposite end of the wire is brought around the bale and drawn taut, after which it is wound around the end of the catch to form an eye. The eye is now inserted through the loop, and the catch is passed through the eye, thus making the tie fast. It will be evident that the pull on the tie band is in the direction of its length, being borne by the loop and the eye, so that the wire body of the tie need not be very thick to insure its stability under the strain to which it is subjected. When the bale is re-pressed, and thus reduced in bulk as well as in girth, the ties may be unhooked and the eye drawn out, after which a second eye may be formed at the proper point. The bale tie may then be hooked fast again by passing the catch through the eye. The projecting ends may be tucked under the tie, and the latter will become somewhat imbedded in the bale, and will thus be protected from injurious wear.

DEVICE FOR PULLING SPOKES.

Pictured in the accompanying illustration is a spoke puller, which should be found specially useful for wheelwrights and other mechanics, as it is arranged to enable them to quickly and conveniently pull out a checked, broken, or otherwise defective spoke from the hub. The device is adapted to slip over the end of the spoke, and is provided with a clamp *A*, by which it is made fast to the spoke. The opposite end of the device is formed with an abutment *B*, which bears against the hub of the wheel. The abutment and the clamp are connected by means of toggle levers, which are operated by a handle *C* and connecting yoke *D*. The yoke *D* is fulcrumed to the links *E* at their junction point, while the handle *C* is formed with a bifurcated head which is fulcrumed to the links *F*. The head of the handle *C* is formed with a pair of angular extensions, which are connected to the free ends of the yoke *D*. It will be evident that when the handle *C* is pulled away from the hub of the wheel, it will draw the toggle links *F* and *E* toward each other, as indicated by the dotted lines in the engraving. This serves to move the clamp *A* in a straight line away from the abutment *B*, and draw the spoke out of the hub. The improved spoke puller may be applied to any spoke without interfering with the rest of the spokes. Furthermore, the double toggle action insures a powerful pull. A patent on this improved spoke

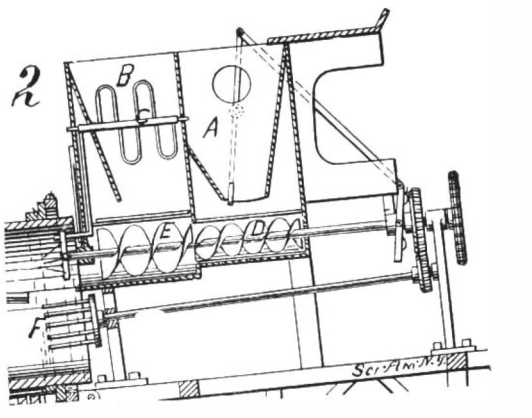


DEVICE FOR PULLING SPOKES.

puller has just been granted to Mr. George L. Preston, of Townville, Penn.

AN IMPROVED PORTABLE CONCRETE MIXER.

The accompanying engraving illustrates an improved machine for mixing concrete, in addition to the fact that it embodies means for readily fixing the proportions of the materials which are to be mixed, and for combining them in a very thorough manner. The details of the machine are shown in the line cut, which is a sectional view of a portion of the concrete mixer. The machine is provided with a hopper *A* for cement, and a hopper *B* for sand. One side of the hopper *A* is adjustable, so as to contract the throat of the hopper to the desired dimensions. The bottom of the hopper *B* is formed with a sliding plate, which serves as a valve for governing the size of the throat. Projecting upward through the throat of hopper *A* is an agitator, which serves to prevent the throat from being clogged, and to permit a continuous flow of cement therefrom. Journaled in the hopper *B* is an agitator *C*, which performs a similar service for the sand supply. Beneath the hopper *A* is a conveyer *D*, which carries the cement to a conveyer *E* under hopper *B*. The conveyer *E* partially mixes the cement with the sand flowing out of the hopper *B*, and conveys the materials into the mixing cylinder. Here the materials drop onto a mixer *F*, which consists of a disk with a series of projecting pins adapted to catch the sand and cement and thoroughly mix them before they fall to the bottom of the mixing cylinder. From this point the materials are turned over and over and mixed in the usual manner by the rotating inclined cylinder. The materials are sprinkled with water from a perforated pipe in the cylinder. The water is supplied from a tank mounted on the machine. This portable concrete-mixing machine is the invention of Mr. R. B. Fulton, of Red Cloud, Neb.



AN IMPROVED PORTABLE CONCRETE MIXER.

AN APPARATUS FOR ELECTRICALLY TRANSMITTING SIGHT.

A recent patent describes an apparatus which will electrically transmit sight in much the same way that the telephone transmits speech. The apparatus is based upon the well-known property of selenium, that when exposed to light its ohmic resistance will vary in inverse proportion to the intensity of the illumination. In the accompanying diagram the transmitting station is seen at 1, and the receiving station at 2. By means of a lens *A* the image to be transmitted is focused through a transverse slot in a traveling belt *B* on to a selenium-coated cell *C*, made up of a series of metal foil strips insulated from each other, but connected along their edges at one side by the selenium coating. The strips lie at right angles to the slot in belt *B*, so that as the light passing through this slot sweeps over the selenium coating, it will simultaneously break down the ohmic resistance of the selenium separating the different foil couples. The resistance in each couple will be proportional to the intensity of the light shining upon it, and it will vary as the slot traveling rapidly across the cell exposes the selenium coating to the various lights and shades of the image. By means of a light-operated switch *D*, which will be presently described, the circuit of each couple in the selenium cell is successively completed through battery *E* and primary winding *F*. The switch *D* operates with extreme rapidity, making and breaking the circuit several hundred thousand times during a single sweep of the slot across the selenium cell *C*. The rapid pulsations of varying intensity thus produced in the winding *F* inductively affect a secondary winding *G*, and are transmitted over the line wire to the receiving station. Here the pulsations produce corresponding fluctuations in the light of a glow lamp *K*. The light of lamp *K* is focused on a screen through the interception of two slots disposed at right angles to each other, one in a belt *L*, which travels at the same speed as the belt *B* and the other in a wheel *M*, which travels with the speed of the switch *D*, the result being that the spot of light cast upon the screen moves transversely from side to side, several thousand times, while at the same time it travels from top to bottom of the screen. The entire surface of the screen is traversed by the spot of light in less than one-fifth of a second.

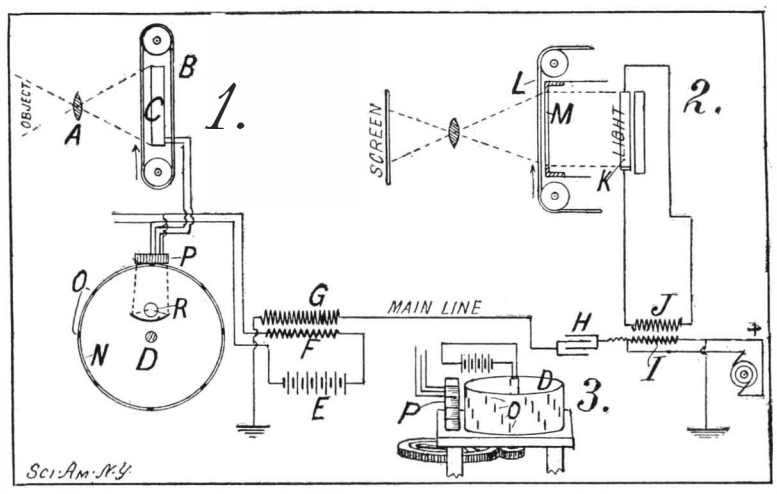


DIAGRAM OF THE APPARATUS FOR TRANSMITTING SIGHT.

The phenomenon of persistency of vision makes it appear as if the entire surface of the screen were illuminated in a single flash; and, as the light on successive points is varied in exact proportion to the light reflected from the object at the transmitting station, an image of this object is formed on the screen. Successive images follow each other with great rapidity, so that the effect is similar to that of a moving picture apparatus. The switch *D* above referred to comprises a drum *N*, formed with a series of slots *O* arranged in staggered relation. A series of superposed selenium cells *P* are placed in front of the slots. These cells are of a construction similar to the cell *C*, being formed with coil couples, each couple connected to a couple in the cell *C*. As the drum revolves, a beam of light from a lens *R* passes through the slots *O*, and sweeps across the selenium coating of the cells *P* successively, completing the circuit of the different couples with the battery and sending out the pulsations over the line. The inventor of this apparatus is Mr. Sidney Rothschild, of 477 Eighth Avenue, New York.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

ANKLE-STAY FOR SHOES.—A. POSNER, New York, N. Y. The object of the present invention is to provide a stay for shoes, arranged to permit of conveniently placing it in position, to properly support or stay a weak ankle, at the same time maintaining the stay at all times in proper position and preventing undue binding at the back of the foot above the heel. It relates to stays such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Posner.

NECKTIE ATTACHMENT.—J. GROSSGEBAUER, Paterson, N. J. The purpose of the inventor is to provide an attachment to the inner face of the inner apron of a four-in-hand or similar tie or scarf, whereby when the tie is in position on the shirt it may hang down over the center line of the bosom, at which point the apron is usually connected, and the apron thus held in such perpendicular position while the clip will be entirely concealed.

CATAMENIAL DRAWERS.—FANNY GUTTMAN, New York, N. Y. The invention relates to women's apparel and the object is to provide sanitary drawers, more especially designed for use during the catamenial period. The arrangement is such that a sheet and pad can be readily placed in position or removed when the drawers are unbuttoned. With the sheet removed and pad detached the drawers can be washed in the usual manner. Means regulate the more or less tight fitting of the article to the ease and convenience of the wearer.

Electrical Devices.

POLE-CHANGER.—L. KIBLINGER, Jackson, La. The particular object of the inventor is to provide a form of changer in which the momentum of the vibrating hammer is employed in such a way as to increase the abruptness of the make-and-break. The magnet used in the changer is improved so as to enable the former to exert greater attraction for the portion serving as an armature.

ELECTRIC TROLLEY.—A. S. JANIN, New York, N. Y. In this trolley the contact roller is in the form of an elongated cylinder which is mounted in ball bearings in the upper ends of a double diamond shaped frame. Each frame section is composed of oppositely pivoted members and a controlling rope has connection with braces on the upper sets of members. The ends of the cylinder contact roller are so formed that the roller readily passes to or from a branch line without the contact being manipulated by the conductor.

INSULATOR AND PROTECTOR FOR ELECTRIC CONDUCTORS.—T. C. COPPING, Houston, Texas. In the present patent the invention is an improved casing for electric wires or conductors, which is adapted to insulate them from trees, posts, or other objects, and to protect them from injury by contact, abrasion, wear, or the like effects.

MAGNETO IGNITING DEVICE FOR EXPLOSIVE-ENGINES.—H. DE LA VALETTE, 111 Boulevard de Menilmontant, Paris, France. The whole of the magneto-igniting device can be swung around its axis of rotation, in either direction according as the ignition is to be forwarded or retarded. The arrangement avoids complication in operating the revolving members and allows an adjustable forwarding by means of simple and compact construction, under the best conditions as to the utilization of the magnetic field.

Of Interest to Farmers.

WEEDER AND STALK-CUTTER.—H. RICHELDERFER, Wasco, Ore. The object of the invention is to provide a device having a truck, independent members mounted behind the truck, and provided with drums presenting helical blades for cutting the stalks of weeds and the like. It rapidly severs the stalks, while at the same time suitably working the surface of the soil for certain agricultural purposes.

MACHINE FOR DESTROYING GRASSHOPPERS.—B. FRANCISCO, Peñablanca, New Mex. A pair of closely adjacent or intermeshing rolls is journaled in the machine frame, the former being rapidly driven from wheels supporting the frame, as the machine is driven over the ground. The grasshoppers, on flying or jumping from the grass, alfalfa, etc., as the machine passes over them, contact with the rolls and are destroyed. Provision is made for collecting a large proportion of the insects flying above the rolls and bringing them in contact therewith from the sides of the machine.

THRESHING-MACHINE.—J. MCCORKELL, Nezperce, Idaho. One purpose of the inventor is to provide a machine simple in construction as well as light of draft, and which requires very little if any more than half the power required by other machines of same capacity, and which will effect a thorough cleaning and prevent smut mixing with the wheat in the event the grain is smutty.

BEET-BLOCKER.—L. F. HAYNES, Brant, Mich. In this case the invention refers to agricultural machines, and more particularly to a type of machine to be dragged along the ground by animals, and provided with cutting mechanism, and thus being adapted for beet blocking. The machine has a high degree of mobility.

INCUBATOR.—G. L. SCOTT, Poplar Bluff, Mo. In this instance an ingenious arrangement of egg holder and its operating devices is disclosed. The holder is in the form of a revolving cylinder and is provided with the desired number of compartments for the eggs. To actuate the holder the inventor utilizes the supply of water such as obtainable from any service pipe; the water is permitted to drop into a bucket which when alternately filled and automatically emptied imparts a step by step movement to the holder. As is usual in incubators, sufficient ventilation means are provided.

COMBINED CORN HARVESTER AND HUSKER.—F. A. INGERSOLL, New York, N. Y. The main frame is adjusted relatively to the tongue so as to raise and lower the front ends of the gathering device; the stalk carrier moves the stalks rearwardly within a slotted passageway; the husking roller extends above and to one side of the slot, and a snapping flange extends above the slot at opposite side from the batting roller to form a bearing for the lower end of the ear, the latter being delivered by the batting roller into an inwardly inclined trough having an ear carrier which delivers ears to the husker, suitable gearing being provided for effecting operation of the several parts.

DISK HARROW AND WEEDER.—F. BUCHET and E. A. MULLINIX, Walla Walla, Wash. The object of the invention is to provide a frame for supporting the disks, and provided with means for raising or lowering the frame to vary the depth of cut or to lift the disks from the ground. Means provide for varying the angle of the disks with respect to the line of draft.

Of General Interest.

REINFORCED CONCRETE CONSTRUCTION.—J. W. MULDOON, New York, N. Y. Neither sidings nor frames are employed to support the concrete; but the inventor places a first row or series of reticulated metal baskets in position, filling them with concrete, placing thereon a second series of baskets, filling them with concrete, and repeating until the structure acquires the desired height, the particular shape and size of the baskets being dependent upon the position in the wall and the nature of structure being built up.

CALENDAR MATCH-SAFE.—F. P. ANDRUS, Almont, Mich. An object in this invention is to provide a device having a perpetual calendar, a receptacle for matches, an abrasive surface for striking the matches thereupon, and adapted to serve as an advertising novelty by presenting surfaces upon which advertisements can be inscribed.

BRACE FOR SCREEN-DOORS OR THE LIKE.—H. C. AXX, Napoleon, Ohio. The invention refers to improvements in braces or supports adapted for use in connection with screen doors, gates and the like, and is designed to be applied to the rails of the gate or door, and to extend diagonally of the same to prevent the outer or free edge from sagging.

NON-REFILLABLE BOTTLE.—H. O. MCCLUAG, Baltimore, Md. The invention relates particularly to an improved air-valve attachment of the stopper, that is, a valve which with co-operating parts is so constructed and arranged that when the bottle is in normal vertical position it prevents ingress of air, but permits it, when the bottle is inverted, so that the contents which would otherwise be retained in the bottle may be freely discharged.

DENTAL SOLDERING APPARATUS.—J. W. HORNER, Columbus, Ind. The invention is designed especially for dental use. The main frame is adjusted to swing the work holding devices over the mat to any desired position or entirely off the mat, or the main frame with its attached parts may be removed bodily to permit the use of a bed, as a soldering block without the crown devices whenever desired.

COFFEE MIXTURE.—A. E. CROCKER, New York, N. Y. In the present patent the invention is a composition of ingredients forming a very desirable and healthful substitute for ordinary commercial coffee, it being a mixture of asparagus berries, figs, and commercial coffee each roasted and ground.

CUT-OFF AND BLAST-REGULATOR FOR GRAIN, ORE, AND MINERAL SEPARATORS.—W. GRAY, Lincoln, Neb. Previous defective operation and result in use of separators are avoided in this instance. It has been sought to escape such errors, by employing a curved segmental slide for regulating the size of the opening in the fan casing through which the air blast is delivered to the spout, but the means for adjusting and guiding the slide have been defective and unsatisfactory for several reasons. The invention is applicable for separators for grain, ore, minerals, seeds, and cereals and a great variety of granular or pulverulent material.

HYDRAULIC WINCH.—J. G. WINGER, Grand Valley, Pa. The aim in this improvement is to produce a winch especially adapted for use in connection with the drilling of oil wells or artesian wells, and for unscrewing or screwing together the sections of the drill or tool joints. It is also specially adapted for moving heavy weights from place to place.

APPARATUS FOR THE MANUFACTURE OF PASTEBOARD BOXES BY PUNCHING.—H. M. P. CATOIRE and J. A. M. MARRET, 10 and 12 Rue des Ardennes, Paris, France. The present process of manufacture is not only very slow but it has also the disadvantage of leaving marks on the constitutive parts of the box, the pasteboard not being pushed into the intervals formed by the separation of the sectors. The invention forms the circular rims of the box and the ledge which receives the cover without leaving any marks on the body of the box or on the cover. The mold employed is made in a single piece, so that the box will have no creases or trace of manufacture.

ANNOUNCING OR ADVERTISING APPARATUS.—E. CHARLES, 164 Avenue Parmentier, Paris, France. This invention has for its object an announcement or advertising apparatus for publicity by day and by night, combined in such manner as to cause to appear, in succession, an inscription or subject with different colorings, or to cause to appear, successively, several different inscriptions or subjects.

SLIME-CONCENTRATOR.—E. C. PORTER, Telluride, Col. By the invention, a set of tables is provided with individual jet or discharge pipes which are moved back and forth over the tables and which discharge successively, by means of automatic valves in the various parts. This gives the full head and jets to each table, and by having narrow nozzles gives more force, with less water. If, however, a large number of tables are used, and water supply is insufficient, the valve-operating devices can be set to sweep several tables at once.

PRINTING DEVICE.—A. L. PATTERSON, Albemarle, N. C. The design in this case is to provide a device for use at the factory for the purpose of adding to the printed labels the subsequent specific number and designations in a rapid, neat, accurate, and convenient manner and at the same time counting out any desired number and announcing the completion of the batch by a bell signal.

BARGE.—J. P. KARR and J. D. RAUCH, Logansport, Ind. The invention is an improvement in the hulls of barges, boats, or floats, particularly such as are used to furnish a flat and stable deck or platform for attachment and support of apparatus employed for operating steam shovels or diggers in land or marine excavations. Such barges should be constructed in the most rigid manner, without unduly increasing the cost.

DIPPER AND DIPPER-HANDLE FOR EXCAVATORS.—J. P. KARR and J. D. RAUCH, Logansport, Ind. The purpose of the improvement is to provide land and marine excavators of a well-known type with a dipper and handle therefor of improved construction whereby certain advantages are attained in respect to rigidity, lightness, and durability, also efficiency in work.

METHOD OF TRANSPORTING BRICKS, ETC.—W. H. FRANCIS, Cherryvale, Kan. This method is for use in transporting in bulk from place to place weighty masses of material in detached but regular aliquot parts, such as bricks. It is designed chiefly for transporting a stack of brick of one hundred or more about a brick yard to or from the drying house and kiln or storage place in a safe and expeditious way. It saves much time in hacking up the same and avoiding the chipping or damaging the edges of the brick.

ENTRY-TAG.—R. H. COSGROVE, Spokane, Wash. The purpose here is to provide a tag especially adapted for marking the exhibits at fairs and similar places and to so construct the tag that a removable gummed or cemented panel constitutes a portion of the tag, the panel being adjacent to the space for the name, or name and address of the exhibitor, the relation of the two panels being such that the removable panel may be folded and secured in position over the name panel, acting as a flap to conceal exhibitor's name until after the exhibit has been judged.

ALBUM.—T. A. MACDONALD, Midvale, N. J. The object here is to provide a construction whereby the album leaf is adapted to receive portraits and also small books in pamphlet form from which can be inscribed the autographs of the persons portrayed or of other persons, and any memoranda which may be inscribed either by the persons portrayed or by others.

SECTIONAL SEWER-MOLD.—G. GEORGENSON, Wilmington, N. C. The design to provide a sectional sheet metal sewer mold, which may be built up in indefinite lengths in the sewer preparatory to packing the cement concrete around the same, and be built up to a higher level by addition of new panels, as the level of concrete rises until the circular form of mold is completed. The mold is also so constructed as to be readily collapsed and taken to pieces from the interior after the cement hardens.

MEASURING DEVICE.—A. E. THOMSON, Sioux Falls, S. D. This device is more especially designed for measuring bolts of cloth or other fabrics, and arranged to enable a storekeeper or other person to readily and accurately determine the yardage of the bolt without resorting to first unrolling the bolt and then measuring it with a yard stick or the like.

KNOCKDOWN BOX.—A. N. MILLER, Evansville, Ind. The invention pertains to wooden receptacles, and the object is to provide a knockdown box for shipping eggs, oranges, bottled goods, and the like, and arranged to permit convenient knocking down of parts for packing the same into a small package, to be returned to the shipper for reassembling of the parts and reuse of the box.

MOISTENER.—M. A. METZNER, Perth Amboy, N. J. The moistener is adapted for moistening stamps or moistening fingers while counting bills, checks, and the like, and the object of the invention is to provide a sanitary moistener presenting a wire gauze surface and so constructed that the surface will be kept moist by a film of water at all times.

PIPE-HANGER.—I. G. LANE, New York, N. Y. The pipe hanger is such as is used for supporting leaders or water pipes. It is especially adapted for supporting pipes which are held in a vertical position. The object of the improvement is to provide a hanger which will operate effectively to support the pipe and prevent it being displaced laterally.

STOVEPIPE-FASTENER.—G. O. HELVIG, Dawson, Minn. The means in this case is adaptable for use in securing together the ends of pipe sections, particularly stove pipes and other pipes formed of sheet metal, and is of such a nature that it may be readily employed in connection with pipes already manufactured, as it does not involve any specific construction of the pipe other than the providing of one of the pipe sections with longitudinally-disposed slots extending inwardly from the end a short distance.

DUMPING-BUCKET.—J. HAMILTON, New York, N. Y. In the present patent the object of the inventor is to provide a bucket effective in operation, durable in use, and provided with dumping appliances adapted to securely hold and prevent the bottom of the bucket from being opened by accident.

BOOK-MARK.—L. B. CHADWICK, Chelsea, Mass. More particularly this invention relates to book marks adapted to be mounted upon a portion of a book, and automatically indicating, when the book is closed, the page at which it was last opened. The mark is adapted to be removably mounted upon a book and operated by the movement of closing the book, to insert an indicating pointer between the pages at which the book is open.

MEANS FOR CAUSING AN AUTOMATIC SCOURING ACTION FOR THE REMOVAL OF SILT FROM RIVER-BEDS AND WATERWAYS.—L. J. AUDOUIN, Poitiers, France. E. M. AUDOUIN, Administrator, 14 Rue Le Cesve, Poitiers, France. This invention relates to a system of oblique barrage intended more particularly for improving rivers having shifting bottoms, the invention being characterized by the employment of adjustable suspended sluice gates for use in producing an automatic scouring action. The sand is automatically removed and deposited in an oblique direction so as not to impede the navigation.

FIREPROOF BUILDING.—P. W. GRASZYNSKI, Tempelhof, Dorfstrasse 19-20, Berlin, Germany. One object here is to provide a building having an assembly room with two fixed floors superposed one over the other and both provided with openings the higher of which is normally filled out of a movable floor adapted to be lowered into the opening of the under-floor and connected with slides which are automatically moved in the higher opening when the movable floor is lowered and so shut off the room from the under floor in a fire and smoke-tight manner.

SAP-COLLECTOR.—M. HALL, De Funiak Springs, Fla. The particular usefulness of this invention is in gathering sap from trees and the like. The object is to provide a sap collector so constructed that the contents are protected from contamination by foreign substances, and which can easily and firmly be secured to a tree or other support.

BRICK MOLDED FOR WALLS WITH A MONOLITHIC INTERNAL SKELETON.—V. COMPAGNONE, Naples, Italy. The purpose of this inventor is to provide a construction of new walls which although composed of various elements separate and distinct, constitute a monolithic whole, and also to provide molded bricks which, by their special form when united and cemented, constitute a structure having a skeleton interior uninterrupted in every direction, whereby a mixmum of resistance is obtained with a minimum of thickness.

MEASURING DEVICE.—F. L. RACOUILLAT and T. P. REID, San Francisco, Cal. One purpose of the invention is to provide a device particularly adapted for dispensing predetermined quantities of pulverized or granulated material, and to so construct the device that it will be compact, economic, and conveniently operated. Means reduce any lumps and insure a proper feed of material to the measuring chamber.

MARINE PROPULSION.—A. E. BEEBE, Mayville, N. D. The improvement is in means for propelling vessels. Any suitable power, engine or otherwise, may be employed for driving the propeller, or in small boats they may be driven by hand by means of a shaft having a sprocket wheel and handles and geared by a chain with a sprocket pinion on a cross shaft. The construction is easily applied to boats, easily operated, and will be found efficient in propelling boats, either large or small.

Hardware.

CURRYCOMB.—P. J. FAUGHNAN, Locust Gap, Pa. The currycomb in this instance is one which is provided with devices adapted for removing hair, dirt, and dandruff from the teeth of the currycomb, such devices being operated when the comb is knocked on a bar, board, or other duly solid or resisting medium.

BELTS, BANDS, AND THE LIKE.—R. SCHEUER, New York, N. Y. The improvement are in retaining loops for use on straps, belts,

bands, etc., and means for securing the same in place, the object being to provide a plurality of loops and secure them in place with the minimum amount of stitching, and hold the loops parallel or at the desired angle to each other, irrespective of carelessness in assembling the parts.

SOLDERING-IRON.—R. Pockman, Yolo, Cal. The invention has reference to a soldering iron of that class in which a liquid fuel reservoir is combined with the iron and certain devices for gasifying the said fuel, so that the gas may be burned with a Bunsen flame to heat the iron.

DOOR-FASTENER.—M. J. Flannery, Bozeman, Mont. The invention is an improvement in automatic door fasteners. It is applicable to a sliding door and may be used on hinged doors, for instance, doors of rural free delivery mail boxes. It is simply constructed and adapted to a variety of uses. When used on car doors a seal may be passed through the lugs instead of a padlock.

KNIFE-SETTING GAGE.—C. H. West, Estabutchie, Miss. The design in this patent is to provide a gage, simple in construction, effective in operation, and adapted to accurately set the knife edges on a cutter head parallel with the axial line of the head thereby insuring a smooth clean-cut surface on the material worked by said knives.

MORTISE-LOCK.—L. S. S. George, Kamloops, British Columbia, Canada. One of the purposes of the improvement is the provision of a lock in which the working parts are few, simple, and compact, and wherein a latch and a bolt operate independently of each other, being operated by a knob and spindle, and the bolt by a suitable key.

SHEARS.—F. W. Schepman and J. M. Teamer, Evansville, Ind. Shears and scissors as heretofore constructed have been seriously defective at the pivot screw inasmuch as it has to be quite tight if the blades are to cut closely, which increases the labor of using the shears or scissors, while on the other hand, if the screw is loosened to render the use of these implements less laborious, the blades wabble and cut unsatisfactorily; another defect is liability of rust gathering around the screw if it remains loose. The invention overcomes these defects.

DRAG-SAW GUIDE.—S. S. Pearl, Stehekin, Wash. The object of this improvement is to provide a simple, strong, and durable guide for drag or cross-cut saws, which may be used for felling standing trees, or sawing up fallen timber, and by means of which it is possible for a single person efficiently and rapidly to operate a large saw.

CHUCK.—N. A. Shigon, New York, N. Y. The primary purpose of the inventor is to provide a chuck with detachable jaws having special clamping ends adapted to hold objects of various shapes, and thereby enable the jaws most suitable for a particular purpose to be applied to the chuck, and removed at will to make place for others. It is especially for jewelers' use, although capable of general application.

Heating and Lighting.

CARBID-FEEDING DEVICE.—N. D. Shaffer, Johnstown, Pa. One object here is to provide a mechanism that will feed a small quantity of carbid into a large body of water automatically and in proportion to consumption of gas; another, a mechanism automatically operated by means of rise and fall of a gas retainer without weights, springs or other energy. The mechanism is positive in its motion and does not require gears, ratchets, chains, cords, springs, or weights. The mechanism feeds carbid of various sizes, separately or collectively.

SAFETY-CLOSURE FOR RECEPTACLES.—L. A. Wilson, New York, N. Y. The object of the invention is to provide a form of closure which will normally prevent the escape of vapors from the receptacle, but which will be opened upon the application of excessive pressure from within and the escaping vapors automatically ignited to prevent the formation of an explosive mixture in the room or space surrounding the receptacle.

OIL-HEATER PROTECTOR.—E. H. Brown, New York, N. Y. The object of this inventor is to provide a protector for oil heaters, arranged to securely hold the heater in place, to prevent persons from coming accidentally in contact with the heater, to catch and retain any drip oil of the heater, and to protect walls or furniture from the deleterious influences of radiating heat. It relates to stoves and furnaces.

LAMP-BURNER.—J. E. Ross, Springfield, Mo. The design in this case is to furnish a burner, arranged to prevent back flash and thus guard against ignition and explosion of the gas generated and contained in the bowl or font holding the liquid illuminant. It relates to lamps using kerosene, alcohol, or like fluids.

Household Utilities.

CHAIR.—W. B. Jackson, Newfield, Pa. The purpose here is to produce a chair of simple construction, having improved means for attaching the legs, back, and braces in position; the general purpose being to produce a chair which will have great strength though light in weight.

CURTAIN-POLE RING.—J. Kroder, New York, N. Y. The object in this case is to provide a ring having portions of the tubular ring doubled up or flattened, to provide a space for readily accommodating the anti-friction rollers, without weakening the ring or unduly enlarging the diameter of the ring for a given size curtain pole. It relates to rings having anti-friction rollers traveling in the pole.

BED FOR THE SICK.—R. Rode, Kragerö, Norway. Among other purposes of this invention is the provision of a sanitary bed, comfortable to the patient and in which the latter may be easily moved to an inclined or upright position, and need not be removed from the bed during the period of defecation.

CORN-POPPER.—G. B. Young and J. H. Young, El Paso, Texas. The invention is particularly useful for popping, salting, and buttering corn, but is equally applicable to, and can be used advantageously in roasting peanuts, chestnuts, and the like, and for cooking or otherwise preparing food products by the application of heat.

Machines and Mechanical Devices.

CLUTCH.—O. Tornfelt, New York, N. Y. More particularly the invention pertains to that type of clutch in which a fluid is continuously circulated within a closed circuit while the clutch is not in operation, and wherein the closing of the circuit to prevent the circulation of the fluid prevents relative movement of the driving member and driven member, thus causing one to be rotated by the other.

LABEL-PASTER.—G. N. Byl and J. Koehler, Jersey City, N. J. The machine deposits labels upon a gummed surface to coat their under faces with an adhesive material, and is so constructed that the labels will be convexed or bellied at their gum-receiving surfaces causing them when applied to such surfaces to engage at their central portions only, thereby preventing the mass of labels becoming glued together at their edges.

BORING DEVICE.—J. W. Cone and F. R. Miller, Barnesboro, Pa. The object of the invention is to produce a portable tool which is especially adapted for boring holes in the beams or rafters of floors. More specifically, the object is to provide a device with improved means for securing in position preparatory to boring the hole.

LAUNDRY-MARKING MACHINE.—C. H. Maiben, Logansport, Ind. The locking is raised and the type block is thrown over into a position such that the type rests on the inking pad by spring action. The article to be marked is placed on a printing block and pressure made upon the treadle which partially rotates the shaft through the strap connection to swing the type block to opposite side of shaft and bring the type into contact with the article. The type block is retained in same relative position with respect to the inking block and printing block during transition by a sliding block and depending pin.

MUSIC-LEAF TURNER.—C. A. Matheny, Montgomery, Ala. In this turner the music sheets are suspended from the top edges, each sheet being received in an individual clasp or holder, and by suitable mechanism a radially swinging turning arm is made to vibrate in a horizontal plane back and forth, as the sheets are successively turned, taking over one at a time, or allowing any sheet to be repeated at will. The frame supporting the turner also supports a lamp.

TRAP.—W. H. Harden, Quitman, Ga. The trap has an entrance chamber, a trap chamber, a passage connecting the entrance and trap chambers, and cage chamber together with a door for entrance chamber, a tilting platform in the latter, means whereby the platform may operate to permit the door to close, a tilting trap door between the trap and cage chambers, and means actuated by the trap door whereby to re-open the door, said means comprising a clock train or power mechanism inclosed in the power chamber at the front of the machine and over the front end of entrance chamber.

BAG-CLOSING MACHINE.—T. J. Brough, Baltimore, Md. This machine is for use in closing or tying the mouths of paper and other bags filled with tea or other commodities put up for sale in small quantities. The closure is effected by means of flexible wire which is passed around and compressed and clamped upon the gathered mouth of a bag, the wire being fed automatically and intermittently as required, and the portion applied to the bag being severed at the proper time.

RECORD-NEEDLE.—H. H. Allison, New York, N. Y. The improvement refers to needles used in connection with talking machines, and has for its object the provision of means capable of producing even, harmonious sounds, free from the chatter, vibrations, and strident tones commonly produced by the devices in use.

POWER-TRANSMISSION MECHANISM.—W. L. Buck, New York, N. Y. In this patent the invention pertains primarily to means for varying the speed of a rotating shaft, and while adapted to be used in various connections it is especially designed for use with automobile and marine power transmission mechanism.

FASTENER FOR REFRIGERATOR-DOORS.—L. G. Coon, Pueblo, Col. This patent shows a fastening device comprising pivoted latches or bolts at the top and bottom of the door at the inside which may be swung to bring their free ends against adjustable wedge blocks on the door frame. Links connect the latches and a handled lever united to the links serves to release the latches or throw them into locking position. There is a second handled lever on the inside of the door so that the latches may be operated from the inside or outside.

SAFETY-CLUTCH FOR ELEVATORS.—M. C. Hutchings, Bozeman, Mont. A passenger or mine elevator is provided with a very simple form of clutch device by this invention. It will act instantly and automatically to stop the car or cage the moment the hoisting cable parts. The clutch mechanism is so constructed that it will safely hold the car stationary until the cable is repaired and draft tension is again applied, at which time the clutch will automatically release.

BAND SAWING-MACHINE.—E. T. Davies, Portland, Ore. The saw frame is made in two sections fitting together face to face and having between them means that support the frame and that arrange the straining gear without interfering with the movement of the frame when raised and lowered by the moving devices. These set the saw up or down to cut at any point, and the supporting frame may be arranged as a stand and may be utilized as a hanger. The saw is toothed for double cutting on its opposite edges, and lumber may be fed from one side of the saw in making one cut and then from the other in the second cut by means of carriages.

CONCRETE-BLOCK MACHINE.—F. Morcher, Tiffin, Ohio. This invention is particularly useful in connection with devices in which a facing liquid is employed to decrease the porosity of the blocks. The object is to provide a simple, strong, and durable machine which can be manipulated with little difficulty and by means of which concrete building of a particularly advantageous form can be manufactured.

CALK-GRINDER.—D. O'Neill, Lucinda, Pa. In operation the frame-work is secured to any support and the shaft is connected with a flexible shaft. The grinding device is held by the grips with the emery wheel toward the operator, and so applied to the calks, the beveled surface of the wheel being used to grind the beveled portion of the toe calks, while the base of the wheel is used to grind the flat sides of the toe calks. Heel calks are ground in same manner, the wheel base being used, however, for the inclined face of said calks.

CASH REGISTER AND INDICATOR.—N. E. Morris, Jr., Murfreesboro, Tenn. The object among others is to provide means whereby the amount of change will be indicated either alone, as in making change, or together with the amount of the sale, or in other words, a machine which will indicate, preferably both front and back, a minuend, a subtrahend (the sale amount), and a remainder, the amount of the change, the machine doing the subtracting.

POWER-TRANSMISSION MECHANISM.—J. L. Nelson, Colona, Col. The primary object here is to provide means for overcoming the dead centers of a prime motor, by means of a rocking weight, so constructed and arranged that when the motor is exerting maximum effect one end of the weight is raised, and as the motor passes one of the dead centers the weight restores itself to its horizontal position, thereby supplying force to carry the motor over the center.

MOLD.—W. J. Miller, Coffeyville, Kan. The improvement is in molds for glass and other articles, and is especially designed for use on glass molds. The mold sections are operated both to closed and opened position by the engagement of the arms of the yoke with the members of the mold sections whereby to dispense with positive connections between the yoke arms and mold sections. The mold is locked by moving the arms past dead center, but good results are secured by moving said arms to or nearly to dead center, it being understood that the mold will lock better the nearer the yoke gets to the said center.

COMBINED SEWING-MACHINE COVER AND CHAIR.—J. Twinem, New York, N. Y. This device is adaptable for use in covering the operating parts of a sewing machine or other similar mechanism, and having combined therewith means whereby the base of the cover serves as a support of a chair adapted to be used by the operator of the machine when the cover is removed.

AUTOMATIC ICE-ELEVATOR.—W. H. Lynch, New Bedford, Mass. The object had in view in this instance is the provision of an automatic ice elevator, more especially designed for elevating the cakes of ice from the water-way to the ice house, in a very simple and economical manner and without requiring attention by skilled labor.

COMPOUND-GEARED FRICTION HOISTING-ENGINE.—J. P. Karr and J. D. Rauch, Logansport, Ind. The inventors have devised an improved hoisting mechanism by which they are able to increase or compound the power within the machine itself, whereby more advantages are attained; and this is effected by means of a simple arrangement of a single gear and pinion and friction wheel on the shaft which is intermediate the hoisting drum and driving shaft.

DYEING APPARATUS.—F. N. Patterson, Lexington N. C. The machine is particularly adapted and intended for applying dyes to cotton or worsted yarn. The object of the invention is to provide a machine in which the dyestuff or liquid will be forced uniformly through the yarn, and then back to the supply vat for repeated use.

Prime Movers and Their Accessories.

MOTOR.—G. P. B. Hoyt, New York, N. Y. The intention in this case is to provide a motor or explosion or internal combustion engine of the two-cycle type, arranged to produce a high auxiliary compression without danger of leakage, to insure a complete removal of the burned gases of the previous explosion by the incoming new charge, without any loss of the latter; and to overcome all vibration by balancing the engine perfectly and thus insuring easy running of the motor.

INERTIA-GOVERNOR.—H. Lentz, 123 Kurfürstendamm, Halensee, and W. Voit, 10 Grünewaldstrasse, Berlin, Germany. The invention relates to an axial governor for steam engines and the like and the object is a governor provided with means for adjusting the same to obtain variations in the speed of the engine. The governor is provided with a spring connected at one extremity with the shaft of the engine, and at the other with an inertia ring influenced by centrifugal weights, and means for adjusting governor for speeds consist in varying the tension of the spring, effecting this by bending the portion thereof connected with the shaft, an adjustable radial pin pressing against said portion.

ROTARY ENGINE.—M. Frauenthal, Conway, Ark. This improved engine is especially adapted for use as an explosive engine, that is, with motive fluids whose expansion is of short duration. The spacing under the inlet port serves the double purpose of, first, permitting the inevitable back pressure of the gases to escape and not be exerted against the oncoming vanes; secondly, eliminating friction. By means of the spacing it is intended to solve the air mixing problem, the air being admitted in the exact quantities necessary.

VALVE-GEAR.—H. Lentz, 123 Kurfürstendamm, Halensee, near Berlin, Germany, and C. Bellens, 43 Rue de Chézy, Neuilly-sur-Seine, France. This invention has for its object means for the operation of distributing valves, such that the corresponding cylinder has the admission and exhaust valves actuated by a shaft, bar, or elongated pin forming a kind of cam shaft with channels profiled normally to the longitudinal axis, a movement of continuous or alternating rotation being imparted to this shaft.

ROTATING MOTOR WITH RECTILINEAR CYLINDERS.—A. Bagnulo, Naples, Piazza Gesù e Maria, Italy. The invention consists of a mechanism for the direct transformation of the rectilinear alternative motion of a piston, under the pressure of any fluid, into continual circular motion. To obtain the continuity of the circular motion the cylinder and piston turn round a fixed axle that bears the whole system.

CARBURETER.—J. H. Miller, Bridgeport, Conn. Mr. Miller's invention relates more particularly to carbureters of the kind used in connection with internal combustion engines, his special object being to improve the control over the admission of combustible vapor and air, so as to suit different conditions under which the engine may at different times be running.

Railways and Their Accessories.

RAILWAY-TRUCK GUARD.—W. Sanford, Vineland, N. J. The object had in view by this inventor is to provide means adapted to be attached to a truck of a railway car of any construction, and to grip the track so as to remove all obstacles from the track and prevent the wheels from becoming derailed, thereby guarding against accidents and enabling the cars to be run with safety at greatly increased speed.

CAR-VENTILATOR.—T. H. Garland, Chicago, Ill. The object of the present invention is to provide a ventilator so arranged as to insure greater efficiency in ventilation and provide for ventilation of berths or compartments in the car that may be separated from the clear story of the car, without danger of smoke, cinders, rain, snow, etc., passing into the car by way of the ventilator.

BRAKE.—J. H. Meredith, Altoona, Pa. The invention relates to brakes such as used on cars, wagons, and other moving vehicles for bringing them quickly to a state of rest. The aim is to produce a mechanism which will operate automatically, as it were, to compensate for the wear which takes place at the brake shoes.

AUTOMATIC BRAKE.—J. Lynch, Van Buren, Ark. The object of this inventor is to produce a brake controllable in its operation by pneumatic means. More specifically the purpose is to provide a brake which is held unapplied by the air pressure in the service pipe, but which is applied by spring pressure when the pressure in the service pipe is sufficiently reduced.

LOCKING DEVICE.—J. P. Geraghty, Jersey City, N. J. This device for use on car doors and the like is arranged to securely hold the door locked, to permit of conveniently unlocking the door and sliding it lengthwise along the side of the car to uncover the door opening, and to allow ready inspection of the seal with a view of determining whether the lock has been tampered with while the car is in transit.

WAGON.—F. Weber, New York, N. Y. The improvement is in children's wagons, relating more especially to that type driven by the operation of a hand-lever. The object is to provide a construction in which the lever may be disconnected from the driving mechanism

and used as an ordinary tongue for pulling and guiding the wagon; this changing of handle or lever from one position to the other being readily effected.

Pertaining to Recreation.

CYCLORAMIC APPARATUS.—R. G. GORDON, Calgary, Alberta, Canada. This apparatus is for use in producing an illusion, and is especially useful where an illusion such as an apparent rocking motion is to be given to the observer. The pictures thrown upon the screen are preferably marine views, and may be changed if desired from mid-ocean views to views including parts of the shore.

TOY.—C. G. FUCHS, Jersey City, N. J. Flat strips bearing preferably the picture of a soldier are pivotally supported on a board and adapted to be stood up in substantially an upright position. Near one end of the board and facing the objects is provided a post connected to a projectile through the intermediary of an elastic cord, and serving when drawn back against tension of cord and aimed to knock the strips or objects down.

BASE-BALL GLOVE OR MITTEN.—E. LITTLE, Granville, Ohio. The object of this inventor is to provide a glove or mitten which will facilitate catching and retaining the ball by the glove. The purpose more specifically is to provide a glove which will have a cavity or recess at the point where the ball is caught, which operates for the purpose stated.

COMBINED ROLLER AND ICE SKATE.—T. SPACIE, Chicago, Ill. In this patent the invention is an improvement in skates, relating more especially to skates in which the foot plate may be detachably connected with either roller or runners, whereby either roller or ice skates may be provided on a single set of foot plates.

SKATE.—G. FLETCHER, Houghton, Mich. This skate is especially for use in playing hockey, but capable of general adaptation. It is adapted to withstand a severe strain and free from recesses or openings of any kind in which snow and similar substances may lodge, and also free from openings into which a stick may enter and trip the user or allow the puck to pass through.

Pertaining to Vehicles.

COMBINED SHAFT AND CROSS-BAR BRACE.—F. M. BELDEN, Sheridan, Ill. The brace is for use for vehicle shafts and their connecting cross-bar, the brace being more especially designed for shafts having downwardly-curved inner ends, and serving to reinforce the shafts and bar in a manner that strains brought to bear thereon tending to break or distort them, or tending to loosen or break connection between the bar and shafts, will be effectually resisted.

ROLLER-BEARING.—E. J. EDWARDS, Los Angeles, Cal. The intention here is to provide a bearing for the hubs of wheels, journals, spindles, and the like, arranged to reduce the friction of the working parts to a minimum, to take up all end thrust, to render the bearing dust-proof, and permit of readily applying the bearing to different sized axles, journals, spindles, shafts, and the like without reconstructing the same.

MOTIVE POWER FOR VEHICLES.—M. SLOTKIN, New York, N. Y. One purpose of the invention is to provide a construction of motive power operating through the medium of pedals or hand levers or both, the construction being such that the pedals or hand levers may be adjusted vertically or laterally, accommodating the device to young or mature persons and to all conditions of length of limb.

COMPOUND ENGINE. — D. PARRETT, Wenona, Ill. The object of this inventor is to provide an engine which is completely balanced and hence capable of running at a high speed without danger of undue wear or jar, arranged to start easily by using live motor agent in the low pressure cylinder, and especially serviceable for use on motor vehicles and the like.

Designs.

DESIGN FOR AN ACETYLENE-LAMP.—F. C. BALDWIN, New York, N. Y. The patentee has evolved a new design which renders an acetylene lamp ornamental while combining usefulness with safety in a compact and attractive form. The upper part comprises a carbide top, valve for dripping carbide and a burner. The lower, a water reservoir and the generator.

DESIGN FOR A COMBINED SEAT AND CABINET.—VIRGINIA D. BURNAM, Huntsville, Ala. In this design there is presented a combination seat and cabinet in which a niche or seat is provided between two upright cabinet-like receptacles, the whole forming an interesting, ornamental, and useful article of furniture which the patentee terms a "Pantheon Niche."

DESIGN FOR A PIN OR BUTTON HEAD.—D. P. BARRY, New York, N. Y. This patent is for a design embodying in its features a flat stippled surface nearly to the borders, in the center of which is an ornamental somewhat V-shaped form. The design is almost square in shape and has slightly rounded corners.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

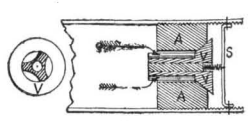
Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

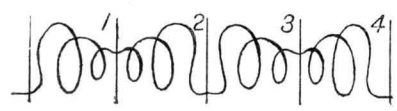
(10661) F. H. G. asks: 1. If a double stereopticon were constructed with the lamp-houses in fixed relation to each other, instead of being hinged at the front to allow for the registering of disks on the screen, and if this registering were accomplished by sliding the objectives up and down in a rigid vertical support, would there be any loss of definition due to the objectives being "out of center" with the condensers? A. The best and, in fact, the only proper position for the system of lenses of any optical instrument is that each lens must be set so that the straight line through the center of the instrument will pass through the center of each lens and cut the central plane of each lens at a right angle. This line is the axis of the instrument, or line of collimation, as it is called in telescopes and microscopes. In the stereopticon the center of the light, the center of the slide, and the center of the picture are also on this axis. This principle requires that all the lenses be in fixed positions, and the instrument as a whole be adjusted with reference to the screen. The only movable part is the rack and pinion motion of the projecting lens, to focus the slide for distance from the screen. Probably there will be a lack of definition on the margin of a slide if the lenses are much out of collimation. 2. Would the degree of distortion be modified in any way by the use of a meniscus in the condenser combination? A. A meniscus lens would have no effect on the condenser if there was distortion of a picture. A meniscus is used in a condenser to reduce the loss of light by reflection. The concave side of the meniscus is placed toward the light, and the rays strike this concave surface at a less angle of incidence, and are therefore less scattered by reflection than in the use of a plano-convex lens in the condenser. 3. In using a meniscus condenser, is anything gained by using *two* plano-convex lenses? Why not use the meniscus in place of one plano-convex, next to the light? A. The best condensers have three lenses, a meniscus next the light and two convex lenses beyond. Of course, their curves are selected so that the light leaves the condenser at the desired angle. A meniscus can be used in company with a plano-convex lens for a condenser if its curves are right. 4. By what law is the focus of a condenser to work with a given objective determined? If the condenser combination is made up of two or three lenses of varying foci, how is the focus of the *combination determined?* A. A lantern condenser is generally equivalent to a single lens of about nine inches focal length. The focus of a system of lenses is determined by calculation. Lummer's "Photographic Optics," price $2, gives the theory of the equivalent focus. It involves the higher mathematics. We also can supply "The Optics of Photography and Photographic Lenses," by Taylor, price $1; "The Lens," by Bolas & Brown, price $1.25.

(10662) W. H. R. asks how to make a valve to be fixed between a gas meter and the main to prevent gas being drawn back through the meter when the main pressure is lessened. A. The accompanying sketch will give some idea of how such a valve works, and how the different parts should be constructed. The part marked *S* is a thin strip of steel fastened across the diameter of the pipe to hold



the spring. *V* is a spool, the center of which has been filled up to the spring and having channels cut away for the passage of gas past the stem of the valve when valve is open. *A* is a piece of cast iron made to screw into the pipe, and into which the spool fits. The gas flows in the direction of the arrow and through the valve. At the instant the pressure of the gas is removed the spring forces the spool into place and closes the passage.

(10663) C. H. P. asks: Will you please tell me what it means about putting the wire coils on the glass tube in building the 4-inch spark coil in SCIENTIFIC AMERICAN SUPPLEMENT No. 1527? Does it mean to connect the coils as if you started from the first coil on to the second and wound the second from outside to inside as below? A. The sections of the secondary of an induction coil are wound, paraffined or otherwise insulated, and then placed upon the tube which surrounds the primary winding. In the case of the 4-inch coil of SUPPLEMENT 1527 this tube is of glass. In winding the coils of the secondary it is usual to wind all



of the sections alike, that is, in the same direction, and then in placing them on the tube to turn the even-numbered sections over and slip them on the tube from the other side of the section. When the inner ends of adjacent sections and the outer ends of the next adjacent sections are connected as described in the plans, the current will traverse the entire secondary in the same direction. The inner end of section 1 is joined to the inner end of section 2, and the outer end of section 2 is joined to the outer end of section 3, and so forth through the sections. As we understand your drawing it is not correct, and we give a correct drawing of several sections of the secondary.

(10664) T. N. W. says: Can you give me a formula for cleaning silk stuffs? A. To wash fine silk stuffs, such as piece goods, ribbons, etc., one cannot do better than employ a soap containing a certain amount of ox-gall, a product that is not surpassed, if indeed it have an equal, for the purpose. In making this soap the following directions will be found of advantage. Heat 1 pound of cocoanut oil to 30 deg. R. (100 deg. F.) in a copper kettle. While stirring vigorously add ½ pound of caustic soda lye of 30 deg. Bé. In a separate vessel heat ½ pound of white Venice turpentine, and stir this in the soap in the copper kettle. Cover the kettle well, and let it stand mildly warmed for four hours, when the temperature can be again raised until the mass is quite hot and flows clear; then add the pound of ox-gall to it. Now pulverize some good, perfectly dry grain soap, and stir in as much of it as will make the contents of the copper kettle so hard that it will give little to the pressure of the fingers. From one to two pounds is all the grain soap required for the above quantity of gall soap. When cooled cut out the soap and shape into bars. This is an indispensable adjunct to the dyer and cleaner, as it will not injure the most delicate color.

(10665) P. W. G. says: Please give me formulas for paste shoe blacking. A. From the many published formulas for shoe blacking we select the following, modifying several of them: I. Bone black, 1¼ pounds; molasses, 1 pound; olive oil, 2 ounces; vinegar, 4 ounces; water enough. Rub the black, molasses, and oil to a smooth paste, add the vinegar, and finally enough water to make a paste of the proper consistency. II. Dissolve casein in a solution of soda, add bone black and a little glucose and oil. The color may be improved by the addition of a small proportion of Prussian blue. III. Tragacanth, 1 ounce; water, 4 ounces; make a mucilage and add neatsfoot oil, 2 ounces; bone black, 2 ounces; sugar, 4 ounces. If too thin, evaporate some of the water by a gentle heat. IV. Soap, 120 parts; potassium carbonate, 60 parts; beeswax, 500 parts; water, 2,000 parts. Mix and boil together until a smooth, homogeneous paste is obtained, then add bone black, 1,000 parts; powdered sugar, 150 parts; powdered gum arabic, 60 parts. Mix thoroughly, remove from the fire, and pour while still hot into boxes.

(10666) R. L. M. asks for formulas for yellow solder. A. 1. Copper, 1 pound; zinc, 1 pound. 2. Stronger—copper, 32 pounds; zinc, 29 pounds; tin, 1 pound. 3. Zinc, 2 parts, with borax; copper, 6 parts. 4. For soldering brass to platinum, put a piece of thick brass wire in a handle, and flatten and file the end like the point of a soldering bit; dip this end in soldering fluid, and, holding it in the flame of gas or lamp, run a little solder on it; now, having put some fluid on the platinum, which will require to be supported with a fine pair of tongs, place it near the flame, but not in it, at the same time heating the brass wire in the flame with the other hand, and as soon as the solder melts it will run on to the platinum; you must put very little on, and take care the solder does not run to the other side. Having applied soldering fluid or rosin to the brass, hold the two together in any convenient manner, and warm them in the flame till the solder runs. It is best to use rosin for electrical work, unless the work can be separated and thoroughly cleaned.

(10667) B. G. S. asks for preparations for taxidermy. A. White arsenic, 2 pounds; white soap, 2 pounds; sugar in powder, 12 ounces; salt of tartar, 12 ounces; chalk in powder, 6 ounces; camphor, 5 ounces. Slice the soap, and melt in an earthen vessel, with water, over a gentle fire, keeping it stirred with a wooden spatula. When melted, put in the sugar, salt of tartar, and chalk. Remove from the fire, and well stir and mix in the arsenic. This soap should be kept in a well-closed glass or earthen vessel. Non-arsenical preparation for anointing skins of animal bodies previous to stuffing: 125 parts by weight of colocynth and 25 parts of aloes with 1,500 parts of water, concentrated by boiling to one-half and strained while hot. Prepare separately 500 parts brown rosin soap and 250 parts of soft soap, melted over a gentle fire and stirred with a little water to a paste. Mix with the first decoction and 125 parts of glycerine and 40 parts of rapeseed oil carefully over the fire. Into the mixture thus produced thoroughly incorporate 50 parts of naphthaline crystals (finely pulverized), 35 parts of oil of turpentine, and 8 parts of carbolic acid.

NEW BOOKS, ETC.

MICROSCOPY. The Construction, Theory and Use of the Microscope. By Edmund J. Spitta. New York: E. P. Dutton & Co. 8vo.; cloth; 468 pages, 47 halftone reproductions from original negatives and 241 text illustrations. Price, $6.

This admirable work deals with the microscope and the principles governing its use from the physical and mechanical side. The book is primarily a practical treatise, describing the various forms of the instrument popular with microscopists, together with the appurtenances and accessories that are necessary for successful manipulation. It should prove useful to all who have anything to do with stands of high magnifying power.

BOLIVIA. By Marie Robinson Wright. Philadelphia: George Barrie & Sons, 1907. 8vo.; pp. 450. Profusely illustrated with maps. Price, $10.

The demand for books on South America has shown a marked increase lately, and the lack of literature hitherto existing on this subject is beginning to be seriously felt in the various libraries, the most important of which can furnish no adequate information regarding the great continent south of Panama. Even the few writers who have taken up the subject have, as a rule, given us only the most general description, embracing in a single volume all they had to say of ten republics, without giving an adequate idea of the past history or the present importance of any one of them. Mrs. Robinson Wright's books on South America are a notable exception, as she has spent fifteen years traveling in the Latin American republics, and has devoted not less than two or three years of travel and study to each, for the exclusive purpose of writing the stories of these countries, and presenting a picture of existing conditions in such a way as to indicate also the possibilities of their future progress.

Four volumes have already appeared from Mrs. Wright's pen, handsomely printed and containing in all more than a thousand illustrations of South American scenes. "Bolivia" is the latest book of the series. It embraces thirty instructive and interesting chapters on the least known of these republics. The author first deals with Bolivia as it was in pre-Columbian times, the empire of an ancient race; then she sketches its history, as a colony of Spain, then Potosi was the center of vast wealth and medieval customs long after these had vanished in the old world; and finishing the historical summary with a description of the noble fight of seventeen years, which finally won the patriots their independence, she proceeds to show what the condition of the country is today, and what efforts its people are putting forth to promote its progress, politically, industrially, and commercially. Bolivia has no foreign debt, but on the contrary has large credits in European banks, reserved for public improvements, especially railroad building. A network of railways is under construction to connect various transcontinental lines from Brazil, Argentine, Chile, etc., which when completed will make this country the great center highway of South American travel.

THE BLACKSMITHS' GUIDE. Valuable Instructions on Forging, Welding, Hardening, Tempering, Casehardening, Annealing, Coloring, Brazing, and General Blacksmithing. By J. F. Sallows. Brattleboro, Vt.: The Technical Press. 16mo.; cloth; 158 illustrations. Price, $1.50.

A practical book of working instructions. Among the subjects treated of are machine and tool forging, welding, hardening, and tempering, casehardening, annealing, coloring and brazing. The instructions are clear, full of useful hints, and plentifully illustrated with diagrams. Though primarily written for blacksmiths the book will prove useful to machinists and toolmakers, as well as to the thousands of farmers and others who attempt occasional emergency ironwork.

HISTOLYSE, SANS PHAGOCYTOSE, DES MUSCLES VIBRATEURS DU VOL, CHEZ LES REINES DES FOURMIS. Par Charles Janet. Extrait des Comptes rendus hebdomadaires des Séances de l'Académie des Sciences, T. 144, p. 393, Paris, 18 février 1907.

HISTOGÉNÈSE DU TISSU ADIPEUX REMPLAÇANT LES MUSCLES VIBRATEURS HISTOLYSÉS APRÈS LE VOL NUPTIAL, CHEZ LES REINES DES FOURMIS. Par Charles Janet. Extrait des Comptes rendus hebdomadaires des Séances de l'Académie des Sciences, T. 144, p. 1070, Paris, 13 mai 1907.

The above two papers by the great authority on ants help to explain the manner in which the bulky wing-muscles of queen ants are transformed so as to meet the new conditions under which the insects live after the nuptial flight.

CONCRETE CONSTRUCTION ABOUT THE HOME AND ON THE FARM. New York: The Atlas Portland Cement Company. 12mo.; paper; 127 pages, illustrated.

There are many minor structures round the home or farm for which concrete is admirably adapted, on the scores both of economy and durability. Concrete construction is so easy that the local builder, or the farmer himself, can carry out simple works without expert help or advice, but this very simplicity has often led to trouble. Too often the builder has not understood his ingredients, or the method of mixing, and by supposing that "anything would do" has got an unsatisfactory result. This book contains practical hints for all kinds of structures, from houses or barns to fence-posts, and should be read by those who propose to do their own concreting.

TIN ROOFER'S HANDBOOK. Compiled by the Joint Committee on Tin Plate for the National Association of Master Sheet Metal Workers of the United States. Philadelphia, 1907.

This is a little booklet of working specifications and practical hints useful to all who construct tin roofs. Tin roofing has many advantages and is deservedly popular, but it has suffered somewhat from the use of inferior tin plate or from improper fixing. The man who has this little book will have no excuse if he does not do satisfactory work. Although in a way a trade publication, the pamphlet is an admirable text-book on sheet metal working.

CONCRETE COUNTRY RESIDENCES. Second edition. New York: The Atlas Portland Cement Company. Quarto; 168 pages, profusely illustrated. Price, $1.

The wide usefulness of concrete to the builder is well shown in this collection of 150 beautifully printed half-tones of concrete residences, ranging from mansions to cottages. The suitability of the material for large business structures also is just hinted at by the inclusion of a many-storied hotel, built of solid reinforced concrete. The book is not only a beautiful one but will have a wide usefulness among those who contemplate building, for most of the illustrations of homes are accompanied by architect's plans. A number of prize designs of suburban houses ranging in price from $2,000 to $8,000, accompanied by sketch elevations and specifications are included. To many who associate concrete with "adobe" structures, or factories, these pictures will come as a revelation.

USE INHERITANCE. Illustrated by the Direction of Hair on the Bodies of Animals. By Walter Kidd. London: Adam & Charles Black. 12mo.; boards; 47 pages, illustrated. Price, $1.

The author takes issue with the widely-spread teaching that acquired characters are never inherited. In the primitive hairy mammals the direction of hair was uniform, sloping from the tip of the snout to the tip of the tail; a type still abundantly represented in many classes of animals. In many animals, notably in man and the horse, the direction of growth is locally changed. Mr. Kidd considers how these changes have originated, and collects a number of interesting data to support his contention that in them we have demonstration of the inheritance of acquired characters. A number of useful illustrations add to the lucidity with which he presents his very reasonable arguments.

REMCO'S MANUAL OF APARTMENT HOUSE SERVICE. New York: The McClure Company. Illustrated; 12mo.; cloth; 327 pages. Price, $1.

This book opens with more than 500 "instructions to janitors," followed by a number of rules and instructions which if faithfully adopted will convert apartment-house employees into something near akin to angels. The greater part of the book deals with the care of plants and property, with advice as to meeting sudden emergencies. A liberal index adds to its value and it should have a wide usefulness among apartment-house employees.

THE SENSE OF TOUCH IN MAMMALS AND BIRDS. With Special Reference to the Papillary Ridges. By Walter Kidd. London: Adam & Charles Black. With 164 illustrations from drawings and microphotographs; 8vo.; cloth. Price, $1.90.

The author traces a close connection between the papillary ridges on the hands and feet of man and of many animals, and the sense of touch. Many diagrams and photomicrographs assist his well thought-out deductions.

THE CHEMISTRY OF COMMERCE. A Simple Interpretation of Some New Chemistry in Its Relation to Modern Industry. By Robert Kennedy Duncan. New York: Harper Bros. 8vo.; cloth; 263 pages, illustrated. Price, $2.

The difference between our industrial system and that of Germany is largely one of efficiency of factory method. While our selling organizations are smooth running machines of the nicest adjustment, our factories are conducted upon principles that are truly archaic. Where our goods are able to compete with those of foreign origin they do so because of greater facilities for obtaining capital, tariff protection, and lack of domestic competition. German products, on the contrary, owe their superiority to the fact that, among other things, their makers are willing to introduce scientific processes into their plants.

American manufacturers are not inherently opposed to science: they are fairly quick to see the advantages of any practical invention founded upon exact knowledge. But the invention must be something new, for, in the main, the heads of our industries are not favorably disposed toward "theoretical" knowledge when it strives to increase the value of rule-of-thumb methods that give reasonably good results. German industrial heads, on the other hand, are more far-sighted, perceiving with almost prophetic powers the possibilities of turning to commercial use discoveries which, at the time, are of purely scientific interest. Moreover, they often support researchers, sometimes for years, in order to have perfected the processes that they require. In the field of chemistry, this quickness to seize upon opportunities, and the dogged perseverance in following them to a golden outcome, are particularly noticeable. Dr. Werner von Bolton, chief of staff in the laboratories of Siemens & Halske, of Berlin, devoted seven years (a very short time compared with some others) to the search for a suitable metal from which to make filaments for electric light bulbs. The result is the tantalum lamp.

It is these fundamental differences that Mr. Robert Kennedy Duncan brings out in his "Chemistry of Commerce." He does it as a side issue, though, for his book is a description, exact and detailed, but popular, of the influences that are revolutionizing the spirit of modern manufacturing. He manifests his love of the subject in a clear, swinging style that carries the reader along, until he himself feels the inspiration that is born of an insight into what was once the unknown.

(It is a pity that so many slight errors, largely typographical, no doubt, should appear in such an excellent work. While these errors do not decrease its value to any appreciable extent, they make one feel that the proofs of the volume should have been more carefully read.)

A COURSE IN MATHEMATICS FOR STUDENTS OF ENGINEERING AND APPLIED SCIENCE. By Frederick S. Woods and Frederick H. Bailey. Boston and New York: Ginn & Co. Vol. I.; 8vo.; cloth; 385 pages with diagrams. Price, $2.40.

A text-book for students of engineering and applied science. The position of the authors as professors of mathematics in the Massachusetts Institute of Technology assures the practical usefulness of the work.

PROBLEMS IN STRENGTH OF MATERIALS. By William Kent Shepard. Boston and New York: Ginn & Co. 8vo.; cloth; 70 pages. Price, $1.30.

This aid to instructors is a collection of nearly 600 graded practical problems, on the strength of materials, for engineering pupils. A chapter on riveted joints, and a number of tables necessary to the solution of the problems are added.

HEALTH EDUCATION SERIES. Numbers 1 to 14. Boston, Mass.: The Health Education League.

With the view of promoting the knowledge of the laws of hygiene, the Health-Education League of Boston, Mass., publishes a series of pamphlets on how to guard one's physical well-being. The booklets are fourteen in number, and deal, in a popular manner, with all of the more important subjects that make for bodily health and vigor. It should be the duty of everyone to assist in the spread of these publications, for we are so closely linked together in our daily life that disease is seldom confined to the individual who by carelessness or ignorance first allowed himself to become a breeding place for the germs that he spreads broadcast. The titles of the series are given below:

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No. 14.—The Care of Babies. Health Card (10 x 14) in Italian. By Gaetano Praino.

Samples of these booklets will be sent postpaid to any address on receipt of price.

VALVE GEARS AND INDICATORS. A Manual of Practical Instruction in Valve Setting, Use of Indicators, and Other Details of Steam Engine Operation Essential to Efficiency and Economy. Part I. Valve Gears. By Walter S. Leland. Part II. Steam Engine Indicators. By Carl S. Dow. Chicago: American School of Correspondence. 8vo.; cloth; 111 pages, illustrated. Price, $1.

The authors have succeeded in producing a practical text-book written in plain and clear language. Formidable-looking formulas are avoided, and the student who wishes to understand his subject will have no difficulty in following them through to mastery. The illustrations materially assist the text.

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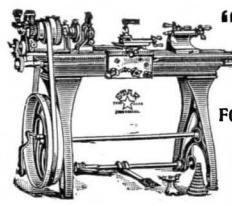

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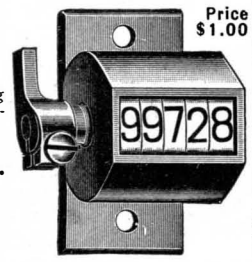

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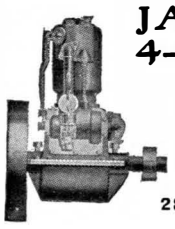

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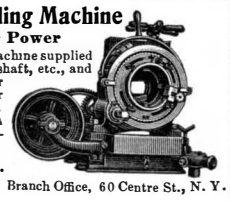

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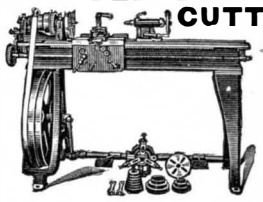

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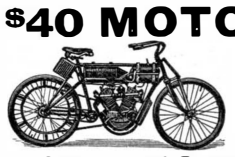

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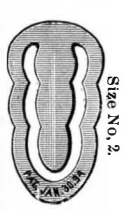

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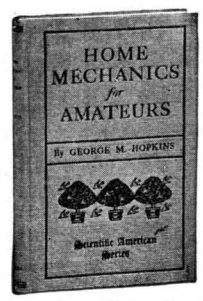

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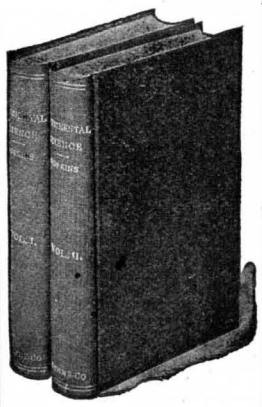

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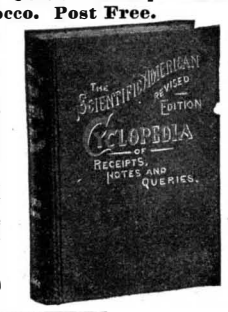

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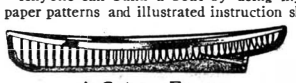

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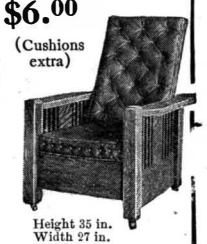

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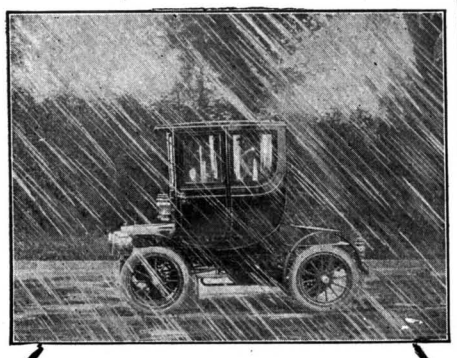

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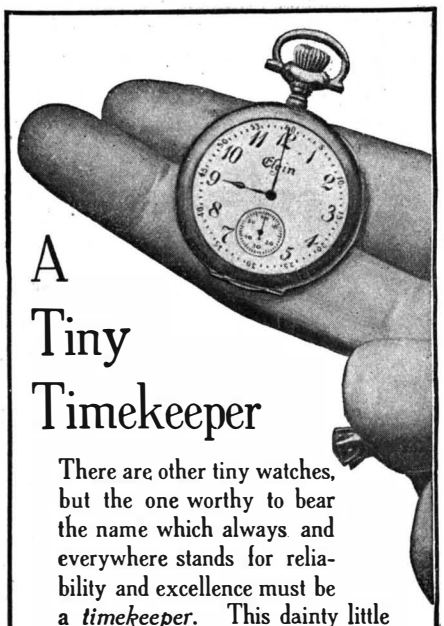

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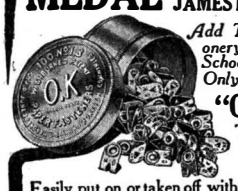

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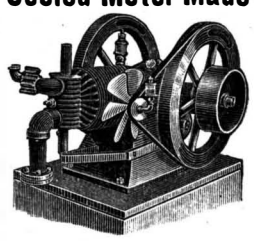

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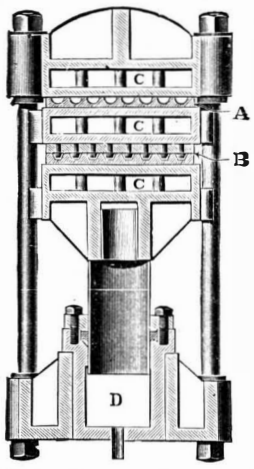

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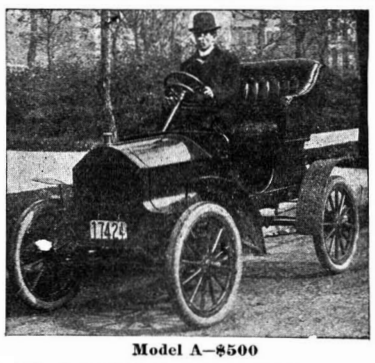

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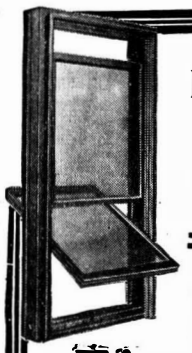

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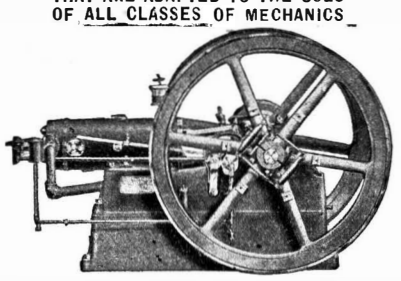

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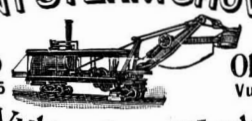

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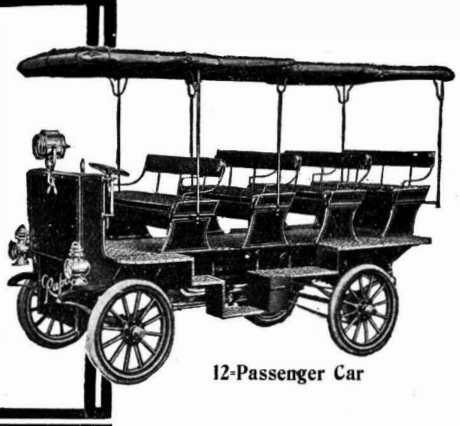

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